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A Modern Silverplate Flatware Factory

How Silver Plated Flatware Is Made and Marketed by the Holmes and Edwards Branch of the International Silver Company of Bridgeport, Conn.

By F. A. WESTBROOK
Mechanical Engineer

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

Of course the manufacture of silver plated flat ware is an infant so far as the age of product is concerned when compared to the alloys commonly referred to as "solid" silver. Nevertheless electro-plating has been done for many years and the products of this process have a wide distribution and occupy an important place in the metal industry.

Electroplating has played an important part in promoting the amenities of living for great numbers of people in that it has made possible the use of attractive table ware of good taste, to all of even the most moderate means, whereas until comparatively recent times only the well-to-do could afford the solid silver which was the alternative to pewter and steel. In other words, silver plated table ware is playing its part in the improved "standard of living."

The commercial introduction of plated silver ware arose out of a curious train of circumstances closely connected with the economic conditions resulting from the Civil War. There were numerous metal button makers, dating from about 1818, in Waterbury, Conn., most of whom supplied brass buttons to the Army and Navy. Naturally during the Civil War they did an enormous business and expanded greatly, as did so many during the World War of our own times. These manufacturers, after the ending of the Civil War, experienced the same difficulties with respect to stock on hand and idle machinery with which we have had to deal during the last decade. So the Waterbury metal manufacturers, like so many in all lines in our own times, tried to find new outlets for their products; and among them were kettles, lamps, daguerreotype plates and base metal for plated silver.

Since that time the silverplating business has grown and prospered to a remarkable degree. Developments in manufacturing technique have kept pace with the general tendency to substitute mechanical power for hand labor to the greatest extent practicable and now the most progressive concerns employ individual electrical drive, electric furnaces and other up-to-date machinery. They have carefully routed their material and have developed the most surprising and successful merchandising plans.

One of the best examples of modern progress along these lines is the Holmes & Edwards branch of the International Silver Company at Bridgeport, Conn. It was established in 1882 primarily to furnish an outlet for a part of the production of the Holmes & Edwards base metal rolling mill in New York. However, it was not long before the rolling mill was given up and the entire attention of the firm centered on the manufacture of plated flat ware at Bridgeport, Conn.

This company of course maintains a very high grade designing staff. These must necessarily be students of the history of the decorative arts and while nowadays they do not actually make the product with their own hands they must, nevertheless, have a good idea of what the machines used in the manufacturing plant can do. Some of the most successful patterns created by this staff are known as the "Romance," "Century," "Pageant," "Jamestown" and "Newport."

One feature exclusive to the Holmes & Edwards ware is the "inlay" process. This consists of inlaying sterling silver in the parts which receive the greatest wear before the actual plating process. It was patented about 1887 by William A. Warner, of Syracuse, N. Y., and came to the attention of Mr. Edwards. He immediately sent his factory superintendent, Mr. Edward T. Abbott, who in his eighty-fourth year is still with the Company, to investigate it. Finding that a practicable process had been developed, which many had tried before but failed to accomplish, Mr. Warner was brought to Bridgeport and ever since that time the inlaid silver has been the foundation principle of this company's product.

With this background in mind a trip through the factory is all the more interesting, after which it will be worth while to give some attention to the very progressive

and unusual merchandising principles employed. Perhaps one of the most striking features about a plant of this kind is the large number of operations, many of them decidedly delicate, through which each piece must pass before it becomes a finished product.

The first series of operations are carried on in a one story building where light comes in from the roof as well as from the sides. It is also very carefully ventilated. These details are particularly necessary because, as we shall see, this is where most of the roughest work is carried on.

These operations naturally have to do with shaping the foundation metal, known to the trade as 18 per cent nickel silver, and consisting of an alloy of copper, zinc and nickel.

BLANKING

The first machines are the blanking presses by means of which the rough outline of the piece is cut out from the raw stock. (See Fig. 1.) The blanks thus made are

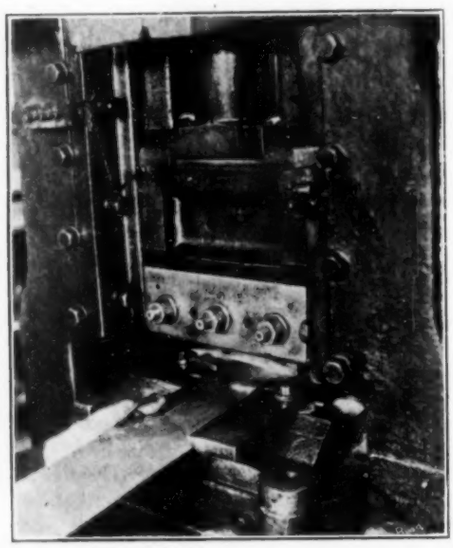

FIG. 1—FIRST OPERATION OF CUTTING BLANKS

hardly recognizable as anything in particular, at least to the uninitiated, but in the next step, known as swedging, it is possible to distinguish a prospective spoon from a fork. This is a squeezing operation whereby the width of the shank of forks, spoons and knives, other than table knives, is reduced, while at the same time the thickness and length are increased. This strengthens the handle and makes the bowl thin and graceful. The introduction of these machines has marked a great advance in manufacturing efficiency because they have eliminated the waste metal formerly incurred when the shape of the shank was secured by cutting.

Before proceeding to the next step of manufacturing it will be worth while to say a few words about the mechanical drive used on the two foregoing groups of machines. Of course electrical motors are used throughout the plant, in most cases individually, for each machine, but in some instances one motor drives a group of machines. The latter method has been employed for the blanking and swedging machines for very good reasons. Every plant engineer knows that it is highly desirable to keep his motors as evenly loaded as possible and that anything in the nature of swedging throws a sudden and heavy load on his motor. Consequently by grouping a number of such machines on one motor the net total load at any instant will not be subject to serious fluctuations.

After passing through these first two rough operations the pieces are washed so as to remove grease, scale and dirt which might cause imperfections in the surface during the rolling operation. They then pass through a rolling process to be still further shaped. This is accomplished in a new type of roll, each driven by its own individual induction motor with chain power transmission. With these machines the most important item (a new development), is the chain transmission. The reason for this is that the reduction in speed between the motor and rolls is so great that belt drive is impracticable. Formerly reduction gears were used but the intermittent character of this type of power transmission, under the conditions encountered here, causes a series of very small ridges, which, nevertheless, are clearly visible and have to be polished off later. This can be avoided by employing chain drive which is much smoother and does not cause any marks on the pieces. The machines are stopped and started by means of push buttons in the motor circuit located directly in front of each operator.

CUTTING

The next step is cutting out the outline of the piece including the making of the tines of the forks. (See Fig. 2.) These machines are ingeniously equipped with

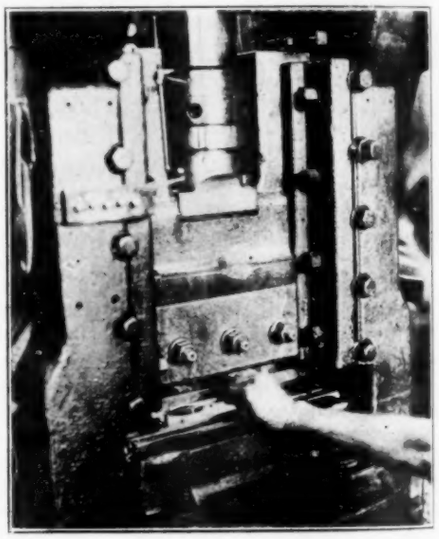

FIG. 2—CUTTING OUTLINE OF PATTERN

an air blast so directed as to blow the trimmings into the waste box as soon as they are cut loose. This not only keeps the machine clear, resulting in better workmanship and greater safety, but keeps litter off the floor.

ANNEALING

All of the operations up to this point, except that of washing, tend to harden the metal so that before it can be successfully worked on up to the plating stage it must be annealed. This is accomplished in a Hevi-Duty electrical furnace, provided with automatic Leeds & Northrup heat regulators.

The pieces are carefully stacked in metal containers and pushed into the furnace by means of a pneumatically operated cylinder. The chamber within the furnace is small and the heating units are arranged all around the interior so as to provide for the uniform heating of the contents. This is very important in order to avoid trouble in subsequent operations. Oil which has accumulated on the pieces in previous operations burns, giving a reducing atmosphere which prevents oxidation and before the blanks are passed out into the air they are allowed to cool down to about 1000° F. in a sealed chamber. They are then cooled to normal room tempera-

ture in a water bath through which they are carried on a conveyor. There are two such furnaces, each with a capacity of 1000 pounds of metal per hour.

As the containers with the annealed pieces emerge from the water they are deposited on a roller conveyor, extending to the pickling bath as shown in Fig. 4. Pickling is done first in a 25% solution of sulphuric acid and then in a mixture of nitric and sulphuric acid. This

FIG. 3—ROLLING AND GRADING THICKNESS OF METAL FOR ENTIRE PIECE

is followed by washing first in soap and then in hot water. The pieces are first taken out of the metal containers used in the annealing furnace and placed in hard rubber containers which will not be attacked by the pickling solution. They are then lowered into the vats and lifted from them, as well as transported from one to another, by a small hand hoist, traveling on a monorail extending over the line of vats. Finally the hard rubber containers filled with the annealed and cleaned pieces are set, by means of the traveling hoist, on a second roller table. This leads to a bench where the pieces are inspected and stacked by girls.

POLISHING

The next operation is the first polishing on machines with individual motors. (See Fig. 5.) These machines and their motors are on benches and the wires for the motors are brought down in conduits from above in a very neat and workmanlike manner. In an old plant where underfloor wiring would mean a terrible tearing up of the floors, unavoidably interfering with production during the change-over, it is usually far better to run the electrical conduit under the ceiling, perhaps on stringers or roof trusses and then to drop down in some convenient manner to the machines. Certainly in this plant the wiring has been very well done and without interfering in any way with freedom of movement.

As each piece is polished it is placed in a wire basket. The polishing material is next washed off in hot water, the baskets being raised and lowered into the vats with a hand hoist which travels on a monorail. The temperature of the water is kept constant with a Fulton automatic temperature regulator placed in the steam line to each vat. Devices such as this naturally relieve the foremen and operators of a great deal of supervision which is subject to all the uncertainties of human frailty and eliminate the danger of improper functioning of the operation as well as, in this case, waste of steam.

FIG. 5—HAND POLISHING

THE "INLAY" PROCESS

"Inlaying" comes next. In actual use the points of greatest wear are at the back of the bowl and handle. Consequently the "blanks" are hollowed out at these points and sterling silver is soldered, or fused, in place of the base metal which has been removed. This is a process which calls for great skill on the part of the operator and has been very carefully developed. Machinery is used as much as possible, as shown in Fig. 6, but it is essentially a hand operation requiring expert manipulation.

FIG. 4—PICKLING DEPARTMENT

STRIKING

The pieces are now ready for the drop hammer which, by the use of dies, "strikes" the handles of spoons and forks to give the proper curvature, "bowls" the spoons and "swedges" the tines of forks, that is tapers them. (See Fig. 7.) This is heavy work and decidedly intermittent in character so that several machines are grouped to one motor in order to keep the power load as uniform as practicable.

FIG. 6—THE INLAYING PROCESS

TRIMMING

This operation leaves the formed blanks with a burr around the edges due to the fact that the impact of the blow forces a small amount of metal to the sides. New machines which consist of endless belts coated with a mixture of emery and carborundum, have just been installed for removing this burr. The blanks are simply held against it by the operator. Each machine is driven by its own individual motor and exhaust hoods have been provided to carry off the trimmings. In fact the operation is known as "trimming." These exhaust hoods, which are used throughout the plant wherever there is liability of dust, mostly in some form of polishing, are important because they protect the worker from inhaling injurious particles or getting them in his eyes, and also because they keep the work clean so that the operator can see what he is doing and avoid scratches which may show up later in the finished product. (See Fig. 8.)

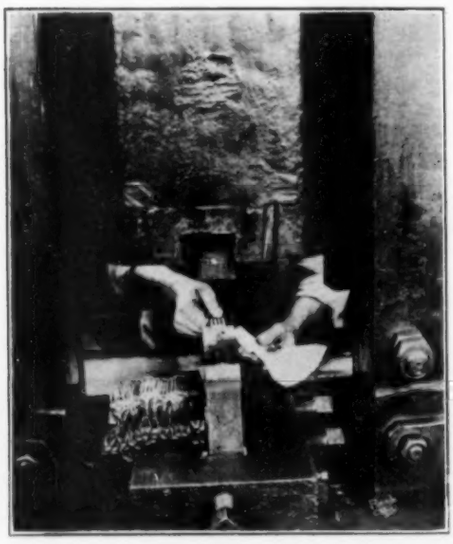

FIG. 7—STRIKING DESIGNS IN HANDLES

In the knife department this is called "glazing" on account of the polish given to the blades. A number of knives are placed in the machine at once and each blade is done over twice. Each girl tends four machines. The blades are done in one spot and the handles in another.

POLISHING

Preparations for plating are now begun by polishing as a clean and smooth surface is essential to proper adherence of the silver film. This is done with pumice on machines having individual motor drive and equipped with exhaust hoods.

FIG. 8—TRIMMING BURRS

Polishing of course will show up imperfections in the inlay so at this stage all blanks are given a very thorough inspection to make sure that they are all right before any more work is done on them. After passing this test they are buffed on a rag wheel with tripoli compound (see Fig. 9) and are then carefully washed in a specially prepared soap, then rinsed in hot water as cleanliness is essential for good plating. This washing is carried out in a manner very similar to that described as preparation for inlaying.

A final very careful inspection follows to make sure

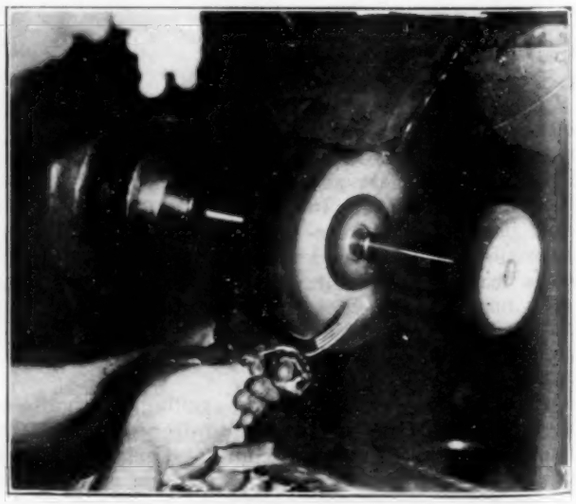

FIG. 9—BUFFING

that no pieces with any defects reach the plating department.

PLATING

The plating is carried on with cyanide solution. The pieces to be plated are placed in racks which revolve through the solution. Plates of silver are placed on each side of the rack for anodes. Immediately before the filled rack is placed in the plating tank it is immersed in a caustic cleaner and then dipped in acid.

Fig. 10 shows some of the circular plating tanks, each of which is equipped with an instrument board whereby the operation may be controlled. Current is shut off automatically, when an alarm bell is rung, when the plating is completed. The preliminary strike is 7 volts and the plating at 2½ volts. Silver, gold, nickel and chromium plating is done, but of course mostly silver.

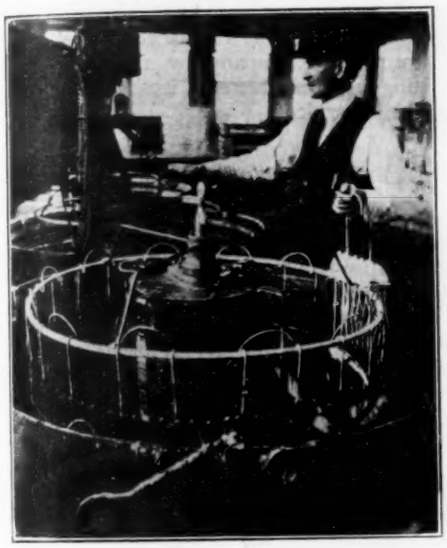

FIG. 10—PLATING

In certain designs where the inlaying has been omitted the back or wear point of the bowls and handle receive an extra plating in the earlier stage of manufacture. In this process the pieces are laid on racks in the solution in such a way that only the parts to be plated are in the solution. This is a newly developed process and requires great care in several respects. It is used for the less expensive grades and as a process to insure wearing quality, cannot be compared to the inlay feature. After removal from the plating solution the pieces are carefully washed in hot water.

Some of the lines have a black design in grooves and intaglios. The process of producing this is called "graying" and consists of applying a black nickel plating and then rubbing off the high lights so as to expose the silver again. It is done with pumice and rag wheels.

BURNISHING AND BUFFING

After plating, the pieces are placed in containers and sent on a conveyer to the burnishing department where they are placed in machines which burnish a dozen pieces at once. (See Fig. 11.) One girl tends four of these machines. This operation gives a smooth, hard finish which adds to the wearing qualities. Finally the bright lustre characteristic of table silver is imparted in the buffing department where each individual piece, one at a time, is buffed on a soft buff wheel with rouge. The buffing machines are driven by individual motors and, as will be seen from the illustrations, a very complete exhaust system has been provided to carry off all particles from the wheels.

INSPECTION AND SHIPPING

Before packing finished goods for stock or shipment, careful inspections are made to eliminate all pieces with imperfections of any kind. At all of the inspection points the benches are placed at the windows and in as many places as practicable where a north light can be secured. Where this is not practicable the benches are so placed as to reduce interference from shadows to a minimum.

MOTORS

As may have been guessed from the many references to the motors and individual drive there are a great many of these machines in the plant—some 300, in fact—and a few words should be said regarding them. In the first place ball bearing motors are used exclusively. They are oiled and looked over every day and thoroughly inspected, and repaired if necessary, every week. Motor maintenance has been greatly reduced by the carefully planned and installed exhaust systems because these, by disposing of dust and grit, reduce to a minimum the amount of foreign material which can find its way into clearance spaces and bearings. A card file is kept with a separate card for each motor giving its mechanical and electrical characteristics, when purchased, where installed, what maintenance it has received and when, and other data. Nothing is left to guesswork or memory and, as any plant engineer will realize, nothing could contribute more effectively to the continuity of operation of all the machines in the plant.

MERCHANDISING

When it comes to the all-important matter of merchandising, Holmes & Edwards is following just as up-to-date policies and methods as in its manufacturing departments. This may be best illustrated by its latest effort known as the "Stepping Stones" plan of dividing a complete silver service into four units which can be purchased one at a time. The plan is based on the instalment-mindedness of the average consumer of to-day.

The idea of the four "Stepping Stones" to a perfect table service is to provide a means whereby a household may acquire its silver by degrees. The first stepping stone is known as the "Starting Service" and consists of only the absolutely necessary teaspoons, tablespoons, knives and forks and two serving pieces, butter knife and sugar spoon. The next unit is the "Essential Service" which adds a number of the items essential for entertaining such as orange spoons, butter spreaders, salad forks and so forth. The third unit is called the "Adequate Service" which includes iced drink spoons,

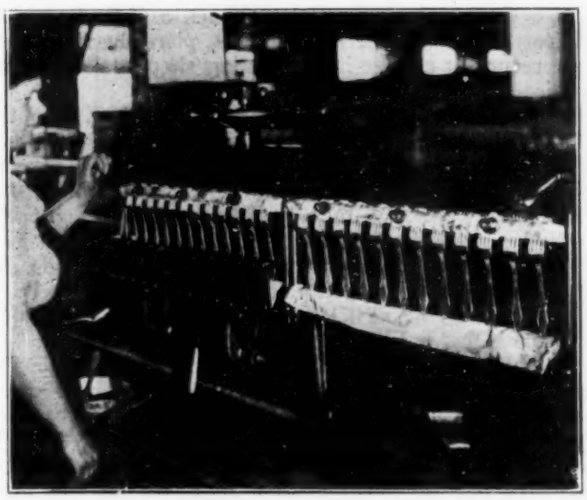

FIG. 11—BURNISHING

bouillon spoons, oyster forks, etc., and the fourth, the "Complete Service," puts on the finishing touches for a complete service, as its name implies, with coffee spoons, afternoon tea spoons and forks, ice cream forks and several other items. Each unit may be had for six, eight or twelve persons and the price of each unit is very nearly the same.

Of course this idea has been announced to the public by carefully planned advertising in several women's magazines of national circulation and the rather unusual plan has been followed of not having the same advertisement appear in all of the papers in the same month so that if a woman sees more than one of these papers in a month, which is quite likely, she will get as many different ideas on the subject. Each advertisement features a booklet which tells about the "Stepping Stones" plan and as a result many thousands have been sent out on request. Dealers are also provided with these booklets as well as with leaflets describing various ways in which purchases may be made, such as club plans, extended credit and out-and-out instalment buying. There are approximately two thousand selected dealers and stores using these.

Another ingenious means of bringing the importance of having correct silverware before the public in a very effective manner is through the domestic science classes in schools. Between twenty-five hundred and three thousand teachers have been furnished with copies of a guide for correct table usage entitled "What to Serve and How to Serve It." A picture of it is shown among the illustrations. This gives details as to suggested menus, tried recipes, correct silver, table arrangement, serving and so forth for every meal, including afternoon tea and buffet suppers. These guides are furnished to the teachers in sufficient quantity so that each pupil may have one and the Holmes & Edwards name is not mentioned until the end where some of the distinctive features are set forth very briefly.

County farm demonstrators are also furnished with the guide, as well as complete sets of silver for demonstration purposes. Last summer a Department of Agriculture train in the wheat belt was furnished in the same way. In other words the Company by following this method of advertising not only benefits itself but is performing a useful public service.

Cracking in Drawn Nickel Silver

Q.—We deep draw nickel silver made of the following best grade metals:

Nickel	17%
Copper	64%
Manganese copper	5 to 30%
Zinc	Balance

Analysis shows 0.1 to 15% iron. Parts are made of this metal continuously, but every two or three months a run of this work is lost due to cracks appearing lengthwise in shells during the cooling, after annealing. Samples are sent herewith.

These shells are cupped and drawn several times, the side walls being reduced .001 to .010 inches at each draw. After this, the shells are annealed at 1200° F., in a closed rotating cylinder; heated and cooled slowly; not quenched. They are then washed ready for the next draw. The difference in wall reduction at each draw seems not to effect this condition and it is believed this trouble is started in the casting or rolling processes. Can you tell us the cause and remedy of this cracking.

A.—Your problem is a complex one to handle from a distance. The fact that with your present practice in the press room you are able to work the metal successfully over long periods of time, and the added fact that this alloy is not, under normal conditions, a difficult one to fabricate, would, in the first analysis, place the trouble on some recurrent change in the casting shop or rolling mill practice.

The primary cause of fire cracking is in relieving the internal stress by heat treating, and this can be complicated by several conditions which can be arrived at only by the slow process of elimination of the differentials, that creep in and produce these intermittent bad conditions. I would suggest the following:

First, a careful analysis of the metal that stands up, compared with the analysis of the defective stock. High iron content in the nickel or high lead in the zinc would exaggerate this trouble.

Second, note whether there has been any change in the brand of metal used in the casting shop, or change in the personnel of the casting crew, or in mold dressing, etc., during the production of the metal that cracks. This is a complex alloy, and the casting of it is full of subtleties. Excessive grain growth after a light rolling and high temperature annealing is considered a contributing cause of fire cracking. Note any changes in treatment in rolling mill that will coincide with the production of the metals that fire crack. Have the laboratory make a "microstructure" of the metal delivered to the press room and compare the "good" metal with the defective metal. This should enable you to localize the trouble quickly.

A careful survey of the press room during the trouble periods should be made. Note any change in personnel or change of tools or in operation of furnace. There is no magic that can solve a problem of this kind, and the only method is the painstaking, plodding one, and the remedy is generally simple. Experiments made in a small laboratory furnace may show that a low temperature and long-time element may relieve the stress and admit of raising the temperature to a proper annealing point. An article published by the American Institute of Mining and Metallurgical Engineers, Oct. 1-16, 1925, written by E. O. Jones and E. Whitehead, on "The Annealing Cracking of the Nickel Silvers," should prove of value to you.

An examination of the samples submitted would indicate a faulty grain structure that had its birth in the casting shop. —W. J. Pettis.

Non-Corrosive Wire for Springs

Q.—In manufacturing special equipment for oil wells we have occasion to use coiled springs of small-diameter wire, the diameters ranging from .080 to .150 in. We have been manufacturing these springs of piano wire. If there is a brass wire which could be substituted for piano wire, we would like to know about it. The reason we wish to substitute brass wire for piano wire is that we think brass wire would be less liable to corrode under the action of salt water and sulphur gases frequently found in oil wells.

A.—The best wire to use for coil springs that come in contact with salt water, alkalis and sulphuric gases is phosphor bronze spring wire.

Commercial brass spring wire can also be used in place of piano wire and costs less than the phosphor bronze wire. The latter has high tensile strength and better wearing qualities. These wires can be procured in the size you specify. It will cost a little more to use the non-corrosive wire but you will be repaid for replacing the piano wire with it by the gain in quality of your product. —P. W. Blair.

British Institute of Metals Meeting

Abstracts of Papers Presented at the Annual Autumn Meeting of the British Institute of Metals, Held in Liverpool, September 5 and 6, 1928

Eighth Report to the Corrosion Research Committee, by R. May.

The Report deals with some further investigations of "impingement attack" which were undertaken in order to interpret the results of certain tests on condenser tubes, and, in particular, to explain the relationship which appeared to exist between the effects of intermittent cavitation in the water, and the effects of air-bubble impingement.

Part I, deals with the behavior of protective films under various conditions of impingement. A method of studying this behaviour by measurements of the "film potential" is described in detail. The method is particularly useful for comparing the healing powers of the natural protective films on different condenser tube alloys, and should be of assistance in the development of specially resistant condenser tubes.

Part II, describes some experimental work which shows that, when there is no intermittent cavitation, "impingement attack" can still take place as a result of air-bubble impingement. This leads to the conclusion that there are two separate main causes of "impingement attack." In addition, the work shows that the size of the air-bubbles entangled in the water is a more important controlling factor than was formerly surmised. Very small bubbles seem to be comparatively harmless, even under conditions of strong impingement.

The investigation has been greatly assisted by the use of the jet-test apparatus, and this has developed into a form which is very convenient for preliminary tests on condenser tubes.

Part III, is largely a discussion of the more important factors controlling "impingement attack" in condensers. The view is taken that there are two main causes—namely, intermittent cavitation as shown by Sir Charles Parsons, and air-bubble "impingement" as shown by Dr. Bengough, R. Pirret, and the author. In either case the mechanism of the action has points of great similarity, and both are known to depend to an important extent on the occurrence of rotating motions of the water.

Definite conclusions are reached regarding the preventions of "impingement attack."

Corrosion at Discontinuities in Metallic Protective Coatings, by Ulick R. Evans.

A study has been made of the corrosion occurring at different kinds of discontinuities in coatings of non-ferrous metals on steel; the work has included sprayed coatings of copper, nickel, and aluminum, and, in addition, coatings of zinc and zinc-iron alloy produced by hot-galvanizing, electro-deposition, spraying, and sherardizing. Various thicknesses of coating types of corrosion.

The cracks produced by bending are more dangerous than uniformly distributed pores. If the coating metal is cathodic to steel, the steel is corroded; copper under some conditions causes marked acceleration of the corrosion of steel at exposed places, nickel being less dangerous. If the coating meal is anodic to steel, the coating suffers corrosion preferentially, the steel thereby receiving protection; thus steel coated with zinc usually suffers no corrosion even at cracks until the zinc becomes exhausted. Steel thickly covered with zinc usually fares better than thinly covered steel notwithstanding the greater tendency to cracking; old galvanized sheet carried more zinc than the modern material and generally lasted longer. Coatings of aluminum or zinc-iron alloys are themselves less attacked than coatings of free zinc, but for that very reason they afford less sacrificial protection to the underlying steel in certain waters. Zinc itself is rather rapidly attacked when partially immersed in a chloride solution, but alternate salt-spraying and drying was found to build up a protective film—a fact which explains certain observations made on the behavior of galvanized iron in service.

The Constitution of the Alloys of Aluminum with Copper, Silicon, and Iron, by A. G. C. Gwyer, H. W. L. Phillips and Miss L. Mann.

After a brief summary of recent work on the binary alloys of aluminum with copper, silicon, and iron, the constitution and structure of part of the ternary systems aluminum-copper-silicon and aluminum-copper-iron are considered. The former of these is shown to be eutectiferrous, with a ternary eutectic of $CuAl_2$, aluminum and silicon, containing 26 per cent of copper, 6.5 per cent of silicon, and freezing at 525° C. The aluminum-copper-iron system is shown to be rather more complex; a peritiectic reaction occurs at 590° between $FeAl_3$ and liquid resulting in the formation of a constituent isomorphous with "X"; the latter forms a ternary eutectic with $CuAl_2$ and aluminum, containing 32.5 per cent of copper, 0.3 per cent of iron, and freezing at 542° C.

The structure and constitution of certain of the quaternary alloys of aluminum with copper, iron, and silicon are also considered. The constituents present, in addition to $CuAl_2$, are those of the aluminum-silicon-iron system, and a quaternary eutectic occurs at 26 per cent copper, 6.5 silicon, 0.5 per cent iron, freezing at 520° C., the constituents being aluminum, $CuAl_2$, "X," and silicon. The paper deals exclusively with metastable conditions.

Laboratory Experiments on High-Temperature Resistance Alloys, by C. J. Smithells, S. V. Williams, B.Sc., and J. W. Avery.

A series of nickel-chromium alloys containing from 10 to 60 per cent of chromium, and a few ternary alloys containing tungsten and molybdenum, have been made from specially pure materials melted in hydrogen. They have been subjected, together with some commercial nickel-chromium alloys, to new forms of test for resistance to oxidation and resistance to sag, at high temperatures.

For the binary alloys resistance to oxidation increases with increase in chromium content up to 30 per cent. With more than 40 per cent of chromium, a second phase appears and resistance to oxidation falls. Ternary alloys containing only 10 per cent of chromium show low resistance, whilst those containing 20 per cent of chromium show high resistance to oxidation. The composition of the oxides formed on the alloys has been determined by X-ray analysis. For high resistance to oxidation the oxide layer must contain at least 50 per cent of chromic

oxide. The composition of the oxide layer is determined by, but is not generally the same as the composition of the alloy.

For the binary alloys resistance to sag at high temperatures decreases with increase in chromium content. The ternary alloys sag more than the binary alloys having a similar nickel content.

The presence of small amounts of impurities has a marked effect in lowering both the resistance to oxidation and sag. Commercial alloys are inferior to the experimental alloys, having the same nominal composition, for this reason.

The electrical resistivity of all the alloys has been determined between 20° and 1,000° C.

The Copper-Magnesium Alloys. Part III, by W. R. D. Jones.

This Paper deals with notched-bar impact tests on forged and heat-treated copper-magnesium alloys. Further evidence has been obtained to show that there is no advantage in adding more than about 2 per cent of copper to magnesium. Alloys containing more than 5 per cent are brittle. The embrittling effect is decreased as the temperature rises. On exposure to cold, the toughness of these alloys has been decreased. Simple heat-treatment does not improve the notched-bar impact values to any appreciable extent.

The effect of forging on the microstructure has been to break down the eutectic network, resulting in an improvement of mechanical properties. Heat-treatment has merely increased slightly the size of the globules of Mg_2Cu and the crystal grains, which are rendered equiaxed and more regular in size.

The Rockwell Hardness Test, by J. E. Malam, Member (Birmingham).

The paper describes work carried out in order to furnish data for conversion between (a) Rockwell and Brinell and (b) Rockwell and scleroscope numbers for copper, 95:5, 70:30, and 63:37 copper-zinc, and 80:20 cupro-nickel.

An examination of these data leads to the conclusion that Rockwell ball test in its present form yields so-called "hardness numbers' which must be considered as quantitatively misleading. Similarly it is found that unscientific results are obtained owing to the arbitrary numbering of the scleroscope scale.

There is an increasing use of methods of testing which yield results having no rational quantitative significance. It is suggested that a representative committee be set up in order to consider the whole subject of hardness testing.

Die-Casting of Copper-Rich Alloys, by R. Genders, R. C. Reader and V. T. S. Foster.

The paper deals with the results of some sections of a general investigation of the die-casting of copper-rich alloys. Exploratory examination of a wide range of alloys in the form of chill-cast bars and die cast test-pieces has indicated that a variety of alloys exists, suitable for die-casting and offering mechanical properties to meet varying requirements. The aluminum brasses which were examined in greater detail, have advantages in their range of properties, high proof stress, slow rate of attack on mold and core materials, and cheapness. Mold and core materials were tested by immersion in molten alloys, both at rest and in continuous motion. High-carbon steel and special steels of the heat resisting type showed little deterioration under the conditions of the tests, while low-carbon steel and engineering steels were rapidly attacked. The behavior of cast iron in molten aluminum-bronze was largely influenced by the phosphorus content of the iron.

Properties and Production of Aluminum Die-Castings, by S. L. Archbutt, J. D. Grogan and J. W. Jenkin.

The paper describes an investigation into (1) production and properties of aluminum alloy "die castings" made in permanent metal molds under gravity feed, i.e., without application of external pressure; (2) hot shortness of aluminum die casting alloys.

(1) Five alloys have been employed in the study of die casting, namely, 4 per cent Cu, 8 per cent Cu, 12 per cent Si, 4 per cent Cu, 3 per cent Si, and Y-alloy.

Two types of casting have been investigated (a) a shouldered test-piece of circular section suitable for testing direct without machining, (b) a hollow tubular casting requiring use of cores in molding, and incorporating flanges and changes of section, features which cause difficulties in casting. Design and treatment of molds, and conditions of working in respect to mold temperatures, pouring, stripping, etc., and the effect of the different alloy compositions on these are described together with the testing and properties of the castings obtained. To overcome defects due to air locks, shrinkage, sticking of cores, etc., very careful control of the working conditions was necessary including metal and mold temperatures, rate of pouring, interval between filling the mold and operations of drawing cores, opening the mold and stripping.

By means of a practised team of workers these operations were carried out with the degree of accuracy needed, and considerable success was thus obtained. Satisfactory castings were produced in the tubular form from all the alloys studied. With the test-piece form castings of satisfactory mechanical strength were obtained in Y-alloy, 12 per cent Si, 3 per cent Cu and 4 per cent Si, but less satisfactory results were obtained with the binary copper-aluminum alloys owing to hot-shortness.

(2) In the investigation into hot-shortness the same five alloys have been studied together with L 5 alloy (Cu 2.5-3.0, Zn 12.5-14.0 per cent). The energy absorbed in fracture of an un-notched test bar cast to shape is taken as a measure of the hot-shortness. Some tests were made on freshly cast bars as they cooled down but the results mainly relate to bars re-heated to a steady temperature.

Hot-shortness is only exhibited at temperatures close to the temperature of commencement of melting. Within narrow temperature ranges the impact strength falls rapidly from the maximum striking energy of the machine to zero or nearly so at the commencement of melting. The range over which the rapid fall in impact strength takes place varies from 5° C. with the 12 per cent Si alloy to 45° C. with L 5.

Die-Casting Alloys of Low Melting Point, by T. F. Russell, and W. Cross, and (in part) N. P. Allen.

Sixteen zinc-base alloys, having either copper and tin, or copper and aluminum, and—in some cases—with further additions of either nickel, cadmium, lead, or magnesium, have been examined microscopically and thermally, and their densities determined. Pressure-cast flat test-pieces were made of each of the alloys and examined for tensile strength, hardness, bending and for porosity, with special reference to the influence of the casting temperature, the temperature of the mold, the size of gate and vent, and the type of pull on the lever of the machine. The porosity depends almost entirely on the kind of pull on the lever, but the differences due to the kind of pull become less as the gate is opened. The copper-aluminum-zinc alloys are approximately twice as strong as the copper-tin-zinc alloys. For any one alloy, the casting conditions—within reasonable limits—have only a small effect on the tensile strength when compared

with the influence of the form of the test-piece, and non-axial loading.

The effects on the strength and on the permanency of dimensions, after atmospheric ageing, have been investigated, and a very large number of tests of the so-called "accelerated ageing" type have been made. The "accelerated ageing" consists in subjecting the castings to the action of hot air, hot air saturated with moisture, and to steam at 100° C. The general conclusions are set out; the most important one being that, within the limits of the compositions examined, the effect of the chemical composition on the rate of growth is insignificant when compared with the effect of the *form* and mechanical condition of the actual casting.

Work on the action of molten zinc and of zinc alloys on different ferrous materials was unfortunately left in an unfinished condition, and only the results of the action of molten zinc are given.

The α-Phase Boundary of the Copper-Silicon System, by Cyril Stanley Smith.

The α-phase boundary of the copper-silicon system has been redetermined by a series of annealing and quenching experiments. The solubility reaches its maximum value, 6.7 per cent silicon, between 721° and 782° C. At 852° C.—the temperature of the peritectic horizontal—the solubility is 5.25 per cent, while at 400° C. is only 4.1 per cent silicon.

The Strength of a Cadmium-Zinc and of a Tin-Lead Alloy Solder, by C. H. M. Jenkins.

A comparison has been made of the relative strengths in direct tension of a cadmium-zinc and a tin-lead solder under both rapid and prolonged tests, conducted at room temperature and at 120° C. Marked differences between the strengths of cast, rolled, aged, and heat-treated material have been observed. Although a general similarity in type between the two materials was found, the cadmium-zinc alloy shows markedly higher values under the various tests. The tensile strength of the cadmium-zinc alloy as ordinarily determined is approximately four times that of the tin-lead solder, but under prolonged stress tests the values obtained are about six times as great.

At 120° C. both materials show a considerably diminished resistance to prolonged stress, the numerical values falling to somewhat below one-tenth of those observed at room temperatures.

Note on Practical Pyrometry, by G. B. Brook and H. J. Simcox.

The paper outlines difficulties, such as stray current and magnetic fields of great intensity, which are peculiar to industries where large currents are used.

An instrument has been designed which eliminates these and is accurate even when placed in the field surrounding a conductor carrying as much as 20,000 amps.

Various minor difficulties are dealt with, and a description is given of a quick-reading thermocouple which is suitable for use in non-ferrous foundries.

Work-Softening of Eutectic Alloys, by F. Hargreaves and R. J. Hills.

Previous work is reviewed and the present state of knowledge on eutectics is briefly indicated.

The micrographic changes on working and annealing the lead-tin eutectic are studied and some explanation is offered of the existence of the critical amount of work observed at about 30 per cent reduction. This corresponds to the same critical value previously found in ball hardness determinations.

A recrystallized sample of eutectic is found to soften when the amount of work exceeds about 20 per cent and this shows that softening is not a pecularity of the eutectic structure but is due to the presence of two phases. The mechanism of distortion is discussed.

Experiments on 0.5 and 15 per cent lead-tin alloys are described. The latter behaves very similarly to the eutectic, whilst the former may be rendered softer than the cast sample by working.

The cadmium-zinc eutectic after preliminary working and annealing is found to behave very similarly to the cast eutectic on being worked again.

It is considered highly probable that the phenomena investigated will be found to be operative during the hot forging of alloys containing more than one phase.

Methods for the Thermal and Microscopic Investigation of Alloys of Reactive Metals, by William Humerothery.

Methods suitable for the thermal and microscopical investigations of alloys of reactive metals are described and criticized, the subject-matter being arranged under the following headings:

1. Methods in connection with cooling-curve experiments.
2. Materials for crucibles and thermocouple sheaths.
3. Methods for obtaining the true composition of the cooling-curve ingots at the moment of solidification.
4. The preparation of chill castings for annealing experiments.
5. Microscopic methods.

The paper then discusses the justification for the method, introduced by the early German workers, in which the composition of a phase is deduced from the duration of the arrests of the cooling curves. It is shown that, whilst difficult to carry out, the method is sound in the case of simple eutectic arrests where no solid solutions are formed. But in the case of peritectic reactions, or where solid solutions are present, the method is by its very nature unsound at all except very high temperatures.

The best methods for use where supercooling or suspended transformation are met with are then discussed.

Note on the Treatment of Aluminum and Aluminum Alloys with Chlorine, by D. R. Tullis.

Most aluminium alloys are known to contain dissolved gases. Various methods have been devised for their removal, and may be described as follows: The Slow Solidification method, the Inert Gas method, the Active Gas method. Various experiments are described in which chlorine gas is used as a means of removing dissolved gases. A theory is advanced to account for the presence of gases in metals. A comparison is given between the slow solidification and the chlorine methods. The results are shown by the difference obtained in the specific gravity before and after the various treatments. Further experiments describe the effects of chlorine gas on (a) alloys of aluminium which are known to extrude metal while cooling, and (b) alloys of aluminium which are known to disintegrate after long or short periods of storage.

Mixture for Slush Castings

Q.—Please give us a metal mixture for casting slush, such as, for example, "lead" soldiers.

A.—The following bixtures are used in making slush castings:

(1)	Lead	87
	Antimony	13
(2)	Zinc	95
	Aluminum	5

One of these will probably suit your purpose.—Ed.

Aluminum Alloys

Pure Aluminum—Aluminum Casting Alloys—Aluminum-Silicon Alloys—Improvement of Mechanical Properties by Heat Treatment — Die-Cast and Permanent-Mold Alloys—Strong Aluminum Alloys and Their Applications

By DR. ZAY JEFFRIES

Consulting Metallurgist, Aluminum Company of America, Cleveland, Ohio.

FROM MECHANICAL ENGINEERING, SEPTEMBER, 1928.

The real aluminum industry dates from the late eighties when Charles M. Hall, a student at Oberlin College, conceived the idea of producing aluminum by dissolving chemically purified bauxite, a hydrated oxide of aluminum, in cryolite and reducing it electrolytically at a temperature near 1,000 deg. cent.

When the aluminum is reduced it is cast into pigs, and as these pigs contain some bath impurity they are remelted and refined in an open-hearth or similar type of furnace and the molten metal then cast into ingots. These aluminum ingots generally contain at least 98 per cent aluminum and a very considerable proportion contain more than 99 per cent.

ALUMINUM OF 99.98 PER CENT PURITY

In recent years meal of 99.98 per cent purity has been made by a special process devised by the late William Hoopes of the Aluminum Company of America, ably assisted by Dr. Frary, Director of Research for the Aluminum Company of America, and Mr. Edwards, Assistant Director of Research.

The obtaining of this very pure metal was a great metallurgical achievement. The process comprises a three-layer bath; a bottom layer consisting of an alloy of aluminum and a heavier metal, for example copper, a molten nonmetallic bath of greater density than molten pure aluminum, and an upper layer composed of the pure liquid aluminum. The aluminum is transferred electrolytically from the lower high-specific-gravity alloy through the bath to the floating layer of pure aluminum, and is tapped from the upper layer.

ALUMINUM CASTING ALLOYS

Pure aluminum is used only to a limited extent in the castings industry, as its properties are not such as to lend themselves to structural uses. The tensile strength is around 12,000 or 13,000 lb. per sq. in. and the elongation on the order of 25 per cent. However, these properties can be changed considerably by varying methods of casting and by varying the purity of the aluminum.

Of the binary alloys there are only three types which are used to any considerable extent. These are the aluminum-copper, the aluminum-manganese, and the aluminum-silicon alloys. Most of the alloys of commerce are ternary alloys or even contain four or more elements, but their bases are as a rule aluminum-copper or aluminum silicon. One alloy, aluminum-manganese, is quite an important binary alloy. When about 1¼ per cent of manganese is added to commercially pure aluminum, the tensile strength is substantially increased and the other properties are sufficiently near the properties of commercially pure aluminum so that the alloy can be substituted for the latter in most places. Furthermore the 1¼ per cent of manganese does not detract from the splendid corrosion-resisting properties of the nearly pure aluminum. This alloy is very important in the wrought-metal field, and is used to a slight extent in the castings industry also.

Table 1 gives a list of what might be termed the standard alloys of aluminum for sand-casting purposes. Two of these, Nos. 12 and 112, or S.A.E. Nos. 30 and 33, are more used than any other alloys in the sand-casting aluminum art.

Another aluminum-copper alloy containing about 12 per cent of copper is used for certain purposes, especially where leakproof characteristics are desired and where more hardness is desired than obtains in the other two alloys. This alloy is somewhat more brittle than the 8 per cent copper alloys, and for that reason is not as good a structural casting alloy as the S.A.E. 30 or 33.

ALUMINUM-SILICON ALLOYS

The aluminum-silicon alloys have been used now for only about six years. Dr. Pacz made the discovery that whereas aluminum-silicon alloys containing, say, 87 per cent of aluminum and 13 per cent of silicon were relatively coarse-grained when cast normally in sand and relatively weak and brittle, they were fine-grained, strong, and tough when treated in the liquid state before casting with a small quantity of sodium fluoride.

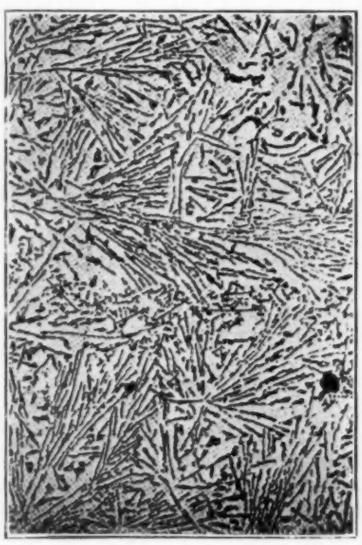

FIG. 1—NORMAL SAND-CAST ALLOY × 100

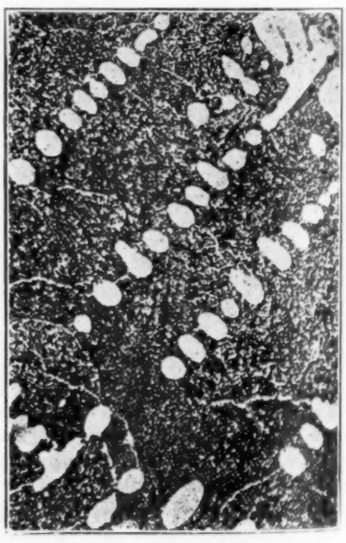

FIG. 2—MODIFIED SAND-CAST ALLOY × 100

Fig. 1 shows the structure of an aluminum-silicon alloy containing approximately 13 per cent of silicon as cast in sand. When that alloy is treated with about 2 per cent by weight of sodium fluoride flux in the liquid state and then poured in sand, the type of structure changes to that

shown in Fig. 2. This is called a "modified" structure. The eutectic is so fine that the silicon is really not resolved at the magnification shown—many of the particles are not at least—and the white material is nearly pure aluminum which contains some silicon in solid solution. The alloy normally should have contained excess silicon, so that the addition of sodium fluoride has modified the whole system.

The explanation for this has been fairly well worked out. Dr. Frary, Mr. Edwards, and Mr. Churchill discovered that this same general effect could be produced by adding metallic sodium. It is now considered that what Dr. Pacz did in his operation was to reduce metallic sodium from sodium fluoride, using aluminum as the reducing agent. The sodium is supposed to dissolve to a slight extent in the liquid aluminum and on cooling separate out into very fine particles and interfere with the free crystallization of the silicon. It so interferes with the crystallization of the silicon that the eutectic freezing point is lowered, and thus an alloy near the eutectic composition is changed to one in which final structure is excess aluminum plus eutectic instead of excess silicon plus eutectic. The eutectic then will be richer in silicon than the so-called normal eutectic.

The 13 per cent alloy in the modified condition has a tensile strength of 25,000-30,000 lb. per sq. in., an elongation of 5-10 per cent, and other properties as seen in Table 1.

TABLE 1. ALUMINUM CASTING ALLOYS

(Properties obtained from unmachined sand-cast test specimens)

Alloy No.	Approximate composition, per cent	Ultimate tensile strength, lb. per sq. in.	Elongation, % in 2 in.	Approx. yield point, lb. per sq. in.	Brinell hardness number
100	Aluminum 99	12,000–14,000	15–25	4,000	25
12	Copper 8 (S.A.E. No. 30)	18,000–23,000	1–3	10,000	65
112	Copper 7.5 Zinc 1.5 Iron 1.2 (S.A.E. No. 33)	19,000–24,000	1–2.5	11,000	65
109	Copper 12	19,000–26,000	0–1.5	15,000	70
43	Silicon 5 (S.A.E. No. 35)	17,000–21,000	3–7	7,000	40
45	Silicon 10	19,000–23,000	1–3	9,000	05
47	Silicon 13 (modified)	25,000–30,000	5–10	11,000	60
106	Manganese 2	16,000–20,000	3.5–6.5	6,000	40
195	Copper 4 (heat treated)	28,000–35,000	5.5–11	18,000	70
196	Copper 5 (heat treated)	36,000–45,000	0–2.5	27,000	115
145	Zinc 10 Copper 2.5 Iron 1.2	25,500–34,000	3–6	12,000	65

The great value of these aluminum-silicon alloys in the castings art is not, however, in their physical properties. That is, it is not essential that the aluminum-silicon alloys have very high physical properties in order to justify their use. They are very fluid in the liquid state, and at the freezing point they are very tough. Because of both of these characteristics the aluminum-silicon alloys are used very extensively in pressure die castings. The walls of such castings are very thin and hence it is desirable to have great fluidity in the molten metal, and as the tendency to crack in a die casting during freezing and shortly after freezing is considerable, the use of aluminum-silicon alloys minimizes two of the greatest difficulties in the die-casting art.

The severe chilling of the aluminum-silicon alloys in a pressure die or in a permanent mold also refines the structure, somewhat like the addition of sodium, and this refinement produces better physical properties than are obtainable in the sand-cast unmodified alloys. In this country the so-called normal alloys containing 5 per cent and about 10 per cent silicon are used in sand castings in addition to the 13 per cent silicon alloy in the modified condition. There is also extensive use in chill molds of unmodified alloys containing up to 13 per cent or even as high as 16 per cent silicon.

HEAT TREATING ALUMINUM ALLOYS

The alloys Nos. 195 and 196 represent an innovation in the castings industry. The theory of this will be considered a little later, but at the moment attention is called to the fact that the composition is aluminum plus substantially 4 to 5 per cent of copper. By proper heat treating, which involves holding at a temperature a little below the fusing point of the eutectic or the most fusible constituent present for a considerable period of time, followed by rapid cooling, with or without a further heat treatment called artificial aging, the properties as shown in Table 1 are obtainable.

With the 196 alloy, which is artificially aged after the rapid cooling treatment, the tensile strength and yield point are increased at the expense of elongation.

The properties can be varied considerably from the figures given by varying the heat treatment and the method of casting, and by using certain other variations.

The aluminum-zinc alloys are not much used in this country and have not been for the last ten or twelve years. Alloy No. 145 finds a limited use in places where considerable strength and toughness are desired.

TABLE 2. PROPERTIES OF HEAT-TREATED ALUMINUM CASTINGS

Alloy No.	Grade	Tensile strength, lb. per sq. in., Min.	Avg.	Max.	Elongation, % in 2 in., Min.	Avg.	Max.	Brinell hardness (1000 kg., 10 mm.), Min.	Avg.	Max.
195	1	28,000	31,000	38,000	6.0	8.0	12.0	50	65	80
195	2	30,000	33,500	40,000	3.0	4.5	8.0	70	75	100
195	3	36,000	41,000	50,000	0.0	1.5	5.5	80	100	140
196	..	32,000	40,000	48,000	0.0	2.0	5.0	..	100	...

Table 2 shows a little more in detail some of the properties which have been obtained from the 195 alloy. By using a very pure aluminum base and by careful alloying and heat treatment, Messrs. R. S. Archer and L. W. Kempf have been able to obtain tensile strengths in aluminum sand-cast bars of 40,000-44,000 lb. per sq. in. with about 18 per cent elongation, properties never even hoped for a few years ago in sand castings which were made of aluminum.

PERMANENT-MOLD ALUMINUM-ALLOY CASTINGS

Table 3 gives the properties of a few of the pressure die-casting alloys, while Table 4 presents similar data on permanent-mold aluminum alloys, that is, aluminum alloys cast in iron molds without the use of pressure. A considerable variety of properties is obtainable using somewhat similar alloys to those previously described for sand casting. The permanent-mold process introduces a chilling effect which is very helpful with respect to the physical properties.

TABLE 3. MECHANICAL PROPERTIES OF DIE-CAST ALLOYS

(Obtained from round die-cast test specimen, 0.252 in. in diameter)

Alloy No.	Approximate composition, per cent	Tensile strength, lb. per sq. in.	Elongation, % in 2 in.	Brinell hardness number
83	Copper 2 Silicon 3	25,000–28,000	3–6	55-65
85	Copper 4 Silicon 5	28,000–30,000	2.5–4	60-70
13	Silicon 13	28,000–30,000	1–3	70-80

STRONG WROUGHT ALUMINUM ALLOYS

Although the aluminum-manganese alloy is a wrought alloy, it is generally considered to be more in the commer-

cially pure aluminum class than the class of alloys shown in Table 5. This group of alloys is popularly known as the "strong-alloy" group. There are three alloys listed here called 17S, 25S, and 51S. The composition of the 17S alloy is approximately 4 per cent copper, ½ per cent magnesium, and ½ per cent manganese.

TABLE 4. PHYSICAL PROPERTIES OF PERMANENT-MOLD CAST ALLOYS

(Standard 0.505-in. test specimen, cast in permanent mold)

Alloy No.	Approximate composition, per cent	Tensile strength, lb. per sq. in., Min.	Tensile strength, lb. per sq. in., Max.	Elongation, % in 2 in., Min.	Elongation, % in 2 in., Max.	Brinell hardness number
43	Silicon 5.0	18,500	24,500	3.0	8.0	40- 45
108	Copper 4.5 Silicon 5.5	21,000	29,500	1.0	4.5	65- 80
45	Silicon 10.0	24,500	29,500	4.5	10.0	45- 56
112	Same as sand-cast 112 (as cast)	21,000	29,000	1.5	3.0	70- 90
122	Copper 10.0 Iron 1.2 Magnesium 0.25	22,000	30,000	0	1.5	85-105
125	Silicon 5.0 Iron 1.0 Tin 2.0	17,500	22,500	4.3	8.0	40- 45
151	Copper 5.5 Iron 1.0 Tin 1.0	20,500	26,500	3.5	7.5	60- 70
152	Copper 10.0	20,500	29,500	1.0	3.0	85-110
195	Copper 5.5	22,000	28,000	3.0	6.0	60- 70
	Heat-Treated Alloys					
	Heat treatment No.					
195	4	35,000	39,000	5.0	9.0	70- 90
195	10	48,000	54,500	1.0	1.5	110-140
122	2	24,000	30,000	0.5	1.5	90-120
122	7	40,000	48,000	0.5	1.0	125-160
122	12	24,500	32,500	0.5	1.0	125-160
122	14	24,000	30,500	0.5	2.0	95-125
122	15	26,000	32,500	0.5	1.5	115-125

TABLE 5. MECHANICAL PROPERTIES OF STRONG ALUMINUM ALLOYS

	17SO	17ST
17S Alloy		
Tensile strength, lb. per sq. in.	25,000-35,000	55,000-63,000
Yield point, lb. per sq. in.	7,000-10,000	30,000-50,000
Elongation, per cent in 2 in.	12-23	18-25
Brinell hardness (500 kg., 10-mm. ball)	42-50	90-110

25S Alloy	25SO	25SW	25ST
Tensile strength, lb. per sq. in.	25,000-35,000	45,000-53,000	55,000-63,000
Yield point, lb. per sq. in.	7,000-10,000	18,000-25,000	30,000-40,000
Elongation, per cent in 2 in.	12-23	15-20	18-25
Brinell hardness (500 kg., 10-mm. ball)	45-50	70-85	90-110

51S Alloy	51SO	51SW	51ST
Tensile strength, lb. per sq. in.	14,000-18,000	30,000-40,000	45,000-50,000
Yield point, lb. per sq. in.	40,000-60,000	15,000-20,000	30,000-40,000
Elongation, per cent in 2 in.	15-30	20-30	10-18
Brinell hardness (500 kg., 10-mm. ball)	25-32	55-70	85-100

"17SO" indicates that the 17S alloy is in the annealed condition. The properties obtained in the second column under the caption "17ST" show what can be accomplished by heat treating this alloy. The heat treatment consists in raising the temperature to about 500 deg. cent., rapidly cooling, and then allowing the material to stand at room temperature for from one to four days. Immediately after cooling the tensile strength is on the order of 45,000 lb. per sq. in., but it begins to increase on standing, and at the end of about four days it has reached a value between 55,000 and 63,000 lb. per sq. in., which represents substantially the maximum strength obtainable by heat treatment of this alloy. The yield point and the Brinell hardness number are increased very substantially by heat treatment, while the elongation is but little affected.

The 25S alloy has different heat-treating characteristics and consequently its properties are listed in three distinct columns. The 25SO or 25S annealed alloy has about the same characteristics as 17SO, and 25ST has the same characteristics as 17ST. The 25SW column represents the properties after quenching and standing at room temperature. This alloy does not age substantially at room temperature. The composition is different from 17S in that it contains no magnesium. It contains somewhat more manganese and a higher silicon content and somewhat higher copper content than 17S. 25S after quenching has its properties changed to the values shown under 25SW. These values will remain substantially as shown for at least a year, and quite likely very much longer.

By reheating to about 150 deg. cent. a further increase in strength, yield point, and hardness is obtained. The properties of this artificially aged material are given in the column 25ST.

The 51S alloy contains substantially 1 per cent of silicon and an amount of magnesium which can vary within considerable limits, say, 0.5 to 1 per cent. In the annealed condition the alloy is very soft—not much unlike commercially pure aluminum. By quenching at a high temperature and aging at room temperature, the tensile strength is raised to nearly 40,000 lb. per sq. in. This alloy ages substantially at room temperature after quenching, but apparently will never reach its maximum properties by room-temperature aging. To obtain maximum strength, yield point, and hardness the aging temperature must be increased to, say, 150 deg. cent., and then the properties shown under 51ST in Table 5 can be obtained.

This 51S alloy is very soft at a high temperature, and shapes can be made of it which are very difficult in the other two alloys. It has nearly the pure-aluminum working properties, with physical properties nearly comparable with those of duralumin.

These strong alloys are made in all sorts of shapes—in sheet, wire, machining rod, forgings, and tubing.

In considering the application of these strong alloys as structural materials, Mr. Archer has drawn up some comparisons which are fairly simple but which give a very complete picture of the comparative properties of steel and the structural aluminum. These are shown in Table 6. For a definite basis of comparison he has considered a steel of 100,000 lb. per sq. in. tensile strength and a 50,000-lb. per sq. in. strong aluminum alloy. The moduli of elasticity are 30,000,000 for steel and approximately 10,000,000 for any aluminum alloy. The specific gravities are about 7.9 for steel and 2.8 for aluminum alloy.

TABLE 6. PROPERTIES OF STEEL AND ALUMINUM BEAMS OF GEOMETRICALLY SIMILAR CROSS-SECTION

	a	a^2	a^3	a^4	Weight	Strength	Stiffness
Steel	1	1	1	1	100	100	100
Aluminum	1	1	1	1	35.4	50	33.3
Aluminum	1.32	1.732	2.28	3	61.4	114	100
Aluminum	1.68	2.82	4.74	7.98	100	237	265

Assumptions

	Specific gravity	Young's modulus, lb. per sq. in.	Tensile strength, lb. per sq. in.
Steel	7.9	30,000,000	100,000
Aluminum	2.8	10,000,000	50,000

At the present time these strong aluminum alloys are used in the manufacture of screw-machine products and for forgings. Most of the propellers on aircraft in this country at the present time are made of the strong aluminum alloys, and they are also being used in the manufacture of chairs which weigh only about one-third what ordinary wooden chairs do. They are also being used to a considerable extent in the construction of railroad passenger cars, and a street car has been constructed in Cleveland largely from these strong alloys.

Cleansing and Coloring Bronze

Q.—Can you give us information on cleansing and coloring of bronze castings? We should like formulæ and procedures for such work.

A.—You do not mention the nature of the bronze castings you wish to color. The procedure for ordinary work is as follows:

Remove burned-in sand by pickling in the following solution:

Water	1 gallon
Commercial hydrofluoric acid	1 pint

The pickle should be contained in a lead-lined tank and heated with lead steam coils to a temperature of 120 to 140° Fahrenheit. After pickling the castings to remove sand, wash thoroughly in cold water, then in hot water.

To produce a bright lustre upon the castings they should be bright acid dipped in the following solution:

Nitric acid, 38°	1 gallon
Sulphuric acid, 66°	1 gallon
Water	1 pint
Muriatic acid	1 oz.

Immerse the cleansed castings in the bright acid dip for a moment or two then remove and wash first in cold then in boiling water. Dry out.

In the production of bronze tablets, etc., the high relief designs or names should be polished with an emery wheel, under usual procedure.

Next cleanse the castings in the following solution:

Water	1 gallon
Caustic potash	1 oz.
Trisodium phosphate	2 ozs.
Soda ash	2 ozs.
Sodium cyanide	½ oz.

Temperature, 200° Fahrenheit.

Following the alkaline cleasing, color the bronze in the following solution:

Water	1 gallon
Copper sulphate	4 ozs.
Potassium chlorate	4 ozs.

Temperature, 200° Fahrenheit.

After immersion for a moment or two in the above coloring solution, rinse in hot water. Then immerse for a moment or two in this solution:

Water	1 gallon
Polysulphide	1 oz.
Ammonia, 26°	¼ oz.

Temperature, 180° Fahrenheit.

After this, remove, wash, dry and relieve the castings by polishing or rubbing down with steel wool as desired.

The following is another solution which may be used for direct coloring or bronze after cleansing as outlined above:

Water	1 gallon
Caustic potash	8 oz.
Polysulphide, 1 oz.; or Barium sulphide	2 oz.

After coloring and polishing to whatever finish desired, all articles should be waxed or lacquered for protection of the finish. —CHARLES H. PROCTOR.

Oxidizing Solution for Brass Plate

Q.—Please furnish a formula and directions of preparing an oxidizing solution for brass plate. We have a tank capacity of fifty gallons and use cold solutions.

A.—A very simple solution that may answer your purpose can readily be prepared as follows:

Water	1 gallon
Muriatic acid	8 ozs.
Powdered iron	1 oz.
White powdered arsenic	1 oz.
Copper sulphate	1 oz.

To prepare the solution, heat up the acid to 140° Fahrenheit, then add the iron and arsenic. When all is dissolved, add this to the water. Dissolve the copper suphlate in a little of the water at 200° Fahrenheit, then mix it thoroughly into the solution.

Steel, carbon or nickel anodes may be used. Always remove steel anodes when the solution is not in operation.

For other solutions, see our PLATERS' WRINKLES, page 20. The solution we have prescribed gives a good black deposit. —CHARLES H. PROCTOR.

Anodes for Chromium Plating

Q.—I am going to use the suggestions that you have made in regard to a chromium plating solution, but there is one other question I would like to have answered.

I find that the anode that I have been using in connection with this solution (which was steel) has become soft, like rubber. Is this what usually occurs with an anode used in a solution of this kind? Is it all right to continue using it in this condition?

A.—The steel anode that you have used in your chromium solution should not become soft, like rubber. The effect is probably due to impurities that were in the steel. We would advise you to discontinue its use and to use pure lead anodes instead. —O. J. SIZELOVE.

Removing Rust from Steel

Q.—We are having trouble in manufatcuring a steel article which is slightly complex in design, being soldered together and then coated with black nickel. Our present method of making them is to place the articles on racks, solder them together, place them in an oil and kerosene mixture for 10 minutes and then in sawdust for a half-hour, then remove, dry in oven and wrap in waxed paper. It seems that about four weeks after this is done, the parts begin to corrode, mainly around the soldered point. In soldering, we use muriatic acid as a flux.

As we have a quantity of these which have rusted up severely, we should like to know of an economical means of taking off the rust. We also would like to know how we can prevent this corrosion from occurring again.

A.—It will be almost impossible to remove the rust which has formed since soldering without destroying the black nickel finish on the part. A muriatic acid pickle would take off the rust but will also remove the black nickel finish.

To prevent rust from occurring again, we would suggest that in the future you use a soldering paste or other flux that contains no muriatic acid. Such preparations are advertised in THE METAL INDUSTRY. After soldering, place the articles in paraffine oil or in sawdust that has been moistened with paraffine oil and leave them there for about 10 minutes. Then dry them in clean sawdust. —O. J. SIZELOVE.

Steel Tank for Hot Nickel

Q.—Can I use a steel tank for hot nickel plating? I would like to have full information in regard to this.

A.—You should not use a steel tank unless it is lined with hard rubber for a hot nickel solution. It is customary to use a wood tank that is lead lined, although a wood tank unlined can be used. —O. J. SIZELOVE.

Meeting of the Electrochemical Society

Abstracts of Papers Presented at the Fifty-fourth General Meeting of the American Electrochemical Society in Charleston-Huntington, W. Va., September 20-22, 1928

ELECTRODEPOSITION OF TELLURIUM

By Frank C. Mathers and Homer L. Turner

Tellurium can be electrodeposited in a firm, smooth condition upon lead cathodes from solutions of tellurium dioxide in mixtures of hydrofluoric and sulfuric acid. Solutions of tellurium dioxide in nitric or in hydrochloric acid give much less satisfactory deposits. All tellurium deposits are brittle, consequently they offer little encouragement for use in commercial electroplating. The deposited tellurium is free from selenium, thus giving a method of refining metallic tellurium. The selenium remains as a slime on the anode.

THERMOELECTRIC MEASUREMENT OF TEMPERATURES ABOVE 1,500° C.

By H. L. Watson and H. Abrams

After a brief discussion of the standard methods of temperature measurement from 1,000 to 2,000° C. (1,832 to 3,632° F.) an account is given of a tungsten graphite thermocouple, including its construction, characteristics and application. This couple has been used, with suitable protection, to over 1,700° C. (3,092° F.) in oxidizing atmospheres. Repeated runs to 1,850° C. (3,362° F.) have been made in the vacuum furnace, as well as short runs to about 2,400° C. (4,352° F.) at atmospheric pressure in reducing atmospheres. The elements when properly selected and treated are interchangeable within 5 per cent and an expression has been range. Automatic recording and control of furnace temperatures obtained for the temperature-e. m. f. relation over the useful in ceramics and steel making have been made possible by use of this couple.

POLARIZATION AND RESISTIVITY IN NICKEL PLATING SOLUTIONS

By Roy L. Dorrance and W. C. Gardiner

Using a Haring cell, the anodic and cathodic polarizations and resistivities of various nickel-plating solutions were measured at 17° C. The anodic polarization was considerably reduced by the presence of chloride ion, although no appreciable difference is noted in the action of the metallic ion, potassium, sodium, ammonium, nickel, or magnesium associated with the chloride ion. The effect of bromide ion is the same as for the chloride ion, while the fluoride ion does not materially reduce anodic polarization. Measurements were also made on other recommended solutions.

POROSITY OF ELECTRODEPOSITED CHROMIUM

By E. M. Baker and A. M. Rente

A study was made of the porosity of chromium deposited from chromic-acid chromium plating baths. Findings of other workers have been confirmed and extended. Within the thickness of nil to 4×10^{-3} mm., a point of minimum porosity was found to exist for all bath compositions and temperatures investigated. The thickness of deposit necessary to give minimum porosity increases with increasing bath temperature, but the least porous deposits can be obtained at higher temperatures, about 55° C. The nature and cause of porosity of electrodeposited chromium are discussed in some detail.

THE CO-DEPOSITION OF COPPER AND GRAPHITES

By Colin G. Fink and James D. Prince

Copper and graphite were co-deposited from acid copper sulfate solutions. Upon electrolyzing "aquadag," the graphite was deposited on the anode. Upon addition of aquadag to acid copper sulfate solutions, graphite was deposited, with the copper, on the cathode. Gelatin was used for stabilization, a little over 1 g./L. being sufficient. Upon analysis, as much as 16 per cent graphite (42 per cent by volume) was found in the cathode deposit, the balance being copper.

STEEL ANODES FOR CHROMIUM PLATING

By E. M. Baker and E. E. Pettibone

Steel anodes are frequently used in chromium plating baths. The effects of variation in the per cent of carbon in the steel on the rate of anode corrosion, and on the oxidation of trivalent to hexavalent chromium, were studied. The steel having the lowest carbon was most resistant to corrosion; and electrolytic iron was more resistant than steel. The equilibrium concentration of trivalent chromium was about the same for all of these anodes.

NICKEL MIRRORS BY THE NICKEL CARBONYL METHOD

By Colin G. Fink and Walter G. King, Jr.

Nickel carbonyl was decomposed in contact with heated glass surfaces, producing perfect mirror deposits. Foreign gases, such as air, must be absent, as otherwise dark spots develop in the mirror. Best results were obtained with glass temperatures at 180° to 200° C. Other materials besides glass were thus coated with nickel. The heat reflectivity of the nickel mirror is almost equal to that of a silver mirror. The deposit has a high electrical conductivity, adheres tenaciously and is tough and resistant. The deposit may serve as a foundation for the electrodeposition thereon of chromium, copper and other metals.

CORROSION IN THE TIN CAN

By Roger H. Lueck and Harold H. Blair

I. THE ELECTROCHEMICAL RELATIONS OF IRON AND TIN

In acid solutions free from appreciable concentrations of oxidizing substance the usual electrochemical relations of iron and tin are reversed, tin assuming an anodic relation to iron. The polarity reversal in the iron-tin cell is due to the large value for the hydrogen overvoltage of tin as compared with that of iron. No reversal occurs if the accumulation of hydrogen on the initially cathodic tin surface is prevented. A hypothesis is suggested to explain the perforating character of certain red fruits, as opposed to many uncolored fruits of equal hydrogen ion concentration which do not perforate.

THE PRODUCTION AND USES OF BERYLLIUM

By Kurt Illig

Although Wöhler obtained metallic beryllium a hundred years ago, by reduction with potassium, it was not until recently that Stock and Goldschmidt produced the metal by the fused electrolyte method. Their method has been developed by the Beryllium Institute, and large masses of metal (150 g.) are now turned out commercially. Properties of certain new metal alloys are enumerated.

Voltmeter, Ammeter, Rheostat

A Description of These Three Plating Room Instruments; How They Are Made and Used—Part 1

By F. T. TAYLOR
Vice-President, Hanson, Van Winkle, Munning Company

FROM THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, JULY, 1928

I have been asked to talk on the voltmeter, the ammeter, and the rheostat. You know, if you had a steel yard you could weigh with it, or you could guess with it, but it wouldn't be of much value to you unless you could interpret the guess and reproduce the guess. Now a steel yard rather accurately represents the rheostat in the plating room circuit. By means of sliding things around, you can get adjustments. But the weights that you slide and the notches on the beam represent the ammeter and voltmeter because by means of the weights and notches you are able to get results that can be read, can be written down, can be reproduced, and can be transmitted to other people. The great value, of course, of weights and measures is the fact that they form units of permanent record, and in these days of communications, our weights and measures are the things that enable us to communicate from one fellow to the other. You weigh out so many ounces of nickel salts because you have it written down or it is in your memory or in a formula, that you need so many ounces of nickel salts to so many gallons of water. So the transmission of data from one fellow to another is one of the great advantages of having reproducing instruments, instruments that can be read.

THE VOLTMETER

The voltmeter and ammeter are instruments to do the reading and recording. It may seem there is no difference between a voltmeter and an ammeter, in their appearance. In the voltmeter we see a permanent magnet, with a north and south pole. Magnets are made of specially heat treated steel so as to retain their magnetism over a long period of time. Between the two poles, mounted on a pivot so it will turn, is a small coil of wire. That coil of wire is connected with a pair of leads leading outside the voltmeter. The coil is maintained in position by means of a circular spring. On the center shaft is mounted a pointer which is going to run across a scale which you can read. As soon as a small current is allowed to go through this coil (and obviously, as the coil has to be very small, the current that can be allowed to go through it is very small) that coil becomes magnetized and as soon as it becomes magnetized, the magnetic force in that coil is immediately affected by the magnetism of this permanent magnet; we have two forces acting against each other, with the result that this coil will turn, and if the amount of current that goes through that coil is sufficient to overcome the spring pressure that coil will finally turn ninety degrees. Here is what that coil is attempting to do, in this turning motion. We have a magnet, north and south pole and if I put between the poles a coil of that character, the magnetic lines of force would tend to thread from the north pole to south pole. A minimum number of those lines of force will go through that coil because the coil actually lies parallel to the direction of those lines. Now that coil has a great desire, a desire in proportion to its strength, to turn itself in such a way that the maximum number of lines of force in the field can thread through it. To put it another way, the coil is much more comfortable when it is chock full of lines of force than when they are just going across from top to bottom of it. That is how this instrument works. Now that is a voltmeter. If you apply these two leads across any two parts of a circuit, in which there is electrical energy you will find that the difference of electrical pressure between those two points cause a current to flow in that coil, and that causes a deflection of the needle.

THE AMMETER

The ammeter is exactly the same. Let us consider a simple plating circuit with the ammeter and voltmeter. Your circuit starts out from the positive side of the dynamo, goes to your anode rod, across the tank to the cathode, and back to the negative side of the generator. Into that circuit we put our ammeter. A lot of current passes across a device called the ammeter shunt, from the two ends of which we have tapped these two little wires leading into the ammeter, and we get an ammeter reading, because what the ammeter is doing, it is reading the voltage drop across the two ends of that shunt at different currents in the shunt. Now one side of the voltmeter is connected to the negative side of the dynamo. Where we put the other side depends on where you want to read the voltage. Would you like to read the voltage at the anode to cathode? If so, you take the other wire and attach it to the anode. I am assuming the resistance of the bus bar from the negative side of the generator to the cathode is nothing. You then get the voltage from anode to cathode. If you want to read the line voltage and find what the dynamo is doing at the tank, you would simply take this lead off and carry it up there, and then you read the voltage across the dynamo. So that the voltmeter, depending upon where you tap one of your wires, will give you the reading of the voltage. The two wires leading from the ammeter are permanently attached to the ends of the shunt, and they have to be carefully attached because the difference in electrical pressure across that shunt on which the ammeter must operate is very small.

WHY VOLTAGE?

Now, before we get to rheostats, of course, we want to answer the question, a fair question, too, I think, "Why do you have voltage in a plating room?" The volt is the unit of electrical pressure; that is the force that drives the current pushes it along, and it will go along directly proportional to the amount of force you have pushing it, and inversely proportional as it is called, to the resistance that is offered to its flow. That is Ohm's law. And that answers the question "Why voltage" in a plating circuit, because you have the resistance of the solution to overcome. You have this thing that has been termed anode and cathode polarization to overcome. Let's say, looking at it in a crude way, but what seems to me an illuminating way, you have to force the current to jump off the anode into the solution, then move across the solution, and when it gets across the solution, you have to force it out of the solution into the cathode. The voltage,

therefore, is the pressure that is needed to force things along.

A diagram of the potential drop, that is, the loss of voltage from anode to cathode, would show a vertical plus line representing the anode rod, and the other line, the negative line, representing the cathode rod. We have the single pole drop of the anode, so-called anode polarization; we have the drop in the solution, and you have the drop from the solution to the cathode, known as cathode polarization. In trying to get some figures that I consider reliable to show you what some of these values might mean, I took the Bureau of Standards Circular 346 on chromium. It is stated in the paper that the distance from the anode to the cathode was ten centimeters (roughly, 5"). The paper states that under the plating conditions given, which were that this particular solution was run at 10 amperes per sq. decimeter, that is, about 100 amperes per square foot, the total voltage required to force that current across that solution was 4½ volts. In other words, if we had taken that voltmeter and tapped it across the bath in this particular diagram, it would have read 4½ volts. Now the question is, where is the 4½ volts used up? You have used up 4½ volts of electrical pressure going from anode to cathode. Where was it used up? According to the diagram, .8 of a volt was used up in getting the current reluctantly to step off the anode into the solution; the drop in the solution is 2.7 volts and the drop from the solution to the cathode is 1 volt.

Now, if you add these figures you will see they add up 4½. I want to particularly call your attention to the fact that the whole 4½ volts was used because in the discussion of rheostats I am hopeful that you can follow the fact that the sum of the voltages all through a given circuit add up to the total line voltage. In other words, in a plating bath, with the assumption that we are starting off with six volts on our dynamo, we will find as we go through the circuit, every time we get back to the point we started, that we will add up six.

WHAT IS AMPERAGE?

Now, what is the ampere? We asked "Why voltage?" Now let's do the same with the ampere. I do not know why it is, but it is a fact that the current actually is what does the metal deposition. It seems to me that "Why the amperage?" is answered by that. Current and time are the two essential factors in electrical deposition, as far as electrical energy is concerned. One other thing that, perhaps, you are not so familiar with that I would like to point out, is this. Electroplating as I see it, is a transfer of electrical energy into electrochemical energy. In other words, it is a change of energy from one form to another. You feed into a solution electrical energy; you get out of it an electrochemical phenomena; namely, change in the character of the metal. The metal is in solution; in other words, it is in liquid form you might say. When it is deposited, it is in metal form, a different form. It is a different form, just as ice is water in a different form. In the plating bath, you have this change from a liquid to a solid. You have done something to it, and, therefore, you have expended energy on it.

Every expenditure of energy we know of in mechanics can be applied to a scale and drawn in figures that are areas. You probably all know that the horsepower of a steam engine is obtained in tests by taking what is known as an engine card. I haven't time to tell you exactly how that is done, but nevertheless this engine card is taken, it is measured carefully, knowing the spring scale at which it is taken, and it is the scale on the back, a pin, that draws the curve, and actually the horsepower of the engine can be calculated from the area of the curve. Now in plating, you have a diagram like this: $E \frac{W}{I}$

"E" is the voltage, "I" is the amperage, the current. If those were plotted to scale and the one side multiplied by the other, we would have the area of the rectangle; in other words, you have an expression of the amount of energy that you had in that circuit. And those two figures multiplied together, E and I, give us what are called by electrical people, watts. The kilowatt you hear about is 1,000 watts. That is the electrical energy in a circuit that you are converting into plating, into electrical deposition. The horizontal line represents the current only, and that line ("I") is the line that actually does the plating. So that your plating is done by the ampere hours, generally written IT.

The part that does the plating has no element of voltage in it at all. Consequently, if it were possible to plate at zero volts, you would be that much better off. IT is what does the plating. But what you are paying for is EIT, or kilowatt hours. IT is what does the plating. The energy you are paying the light company for is to be found by multiplying the voltage times the current times the time you had to run it, while the amount of plating itself would be the number of amperes that flow into the plating bath, multiplied by the time that they flow.

Now the reason I have pointed this out to you is that I have shown you that this, EIT, is what you have to pay for, and this, IT, is what you get, and consequently, the lower you keep E, the cheaper it is going to be to your plating. In other words, you don't want to plate at high voltage; you want to plate at a low voltage, and as low as can be. That is to say, if we could have a dynamo that would give us exactly 4½ volts on this other bath here, with no rheostat or anything of the sort, we would have reduced this "E" to the lowest possible value, as long as it can go and produce enough energy to force that electrochemical change to take place.

This article will be continued in an early issue.—Ed.

Chromium Solution

Q. I have had very little success with the following chromium solution:

Water	1 gal.
Chromic chloride	24 ozs.
Potassium chloride	16 ozs.

Voltage, 4 to 5; amperage, 40 to 50 per sq. ft.; ordinary temperature.

With this solution I could not produce any plate. I then took part of this solution and added sulphuric acid. With this I got a very fine deposit, but it rubbed off with the finger. I have a 5-gallon jar, use lead anodes, 6-volt generator, 750 amperes. I have this connected to the two bus bars and also on a rheostat. Can you give me further information on this subject?

A. I do not recommend the bath that you are using. Try the following one:

Chromic acid	33 oz.
Sulphuric acid	0.3 oz.
Water	1 gallon

Use lead anodes, heat solution to 113° F.; current density, 100 to 200 amperes per sq. ft.

Write to the Bureau of Standards, Washington, D. C., for a copy of Technologic Paper No. 346. This paper contains valuable information on chromium plating.

—O. J. SIZELOVE.

Lead Poisoning and Its Precautions

By JAMES SILBERSTEIN

The poisonous effects of lead were mentioned by Hippocritus of the fifth century B.C., and physiological effects of lead have therefore been subject of much study. An extraordinary number of reports and notes have been written on lead poisoning.

Chronic lead poisoning is produced by the introduction into the system of minute quantities of a lead compound or lead itself. The sources from which the lead may be derived in chronic lead poisoning are numerous and diverse. There are occupational risks which attend the use of lead or lead compounds in many trades such as painting, plumbing, pottery glazing, glass working, making lead compounds—litharge, red lead, white lead, etc.—making accumulators, enameling iron, smelting metals and printing. There are also the so-called accidental risks, where people in ordinary avocations are endangered by negligence or ignorance owing to the extensive employment of plumbiferous materials for so many purposes in everyday life. Lead is a cumulative poison and the absorption of a minute quantity at a time but extended over a long period may prove disastrous.

Some people are particularly susceptible to the influence of lead poisoning while others seem to resist its action or to tolerate the poison to a considerable extent. There are cases where men have been employed in lead smelting plants for years and years without any sign of lead poisoning. These cases are, however, exceptions and they should under no circumstances serve to indicate that lead is not poisonous.

The chief symptoms of chronic lead poisoning are general ill health, usually referred to as indigestion; the appetite is lessened and constipation occurs; there is a disagreeable taste in the mouth; the skin acquires an unhealthy color, being at first yellowish and subsequently anaemic; the gums often show a bluish-black line—produced by lead sulphide—generally called a "lead line." In addition, there may be lead colic; pains in the joints; partial paralysis; dizziness and sleeplessness, which may further develop to drowsiness or to insanity.

The protection of the workers from fumes and dust by exhaust ventilation and use of respirators and promotion of cleanliness have caused a large decrease in lead poisoning. Other precautions are as follows:

The workers should drink plenty of milk, at least one quart a day, since this aids in removing lead from the system. Should the first symptoms of lead poisoning—indigestion and constipation—appear, a dose of one tablespoon of epsom salts dissolved in water should be taken once a day, in the morning, for two to three days. If the gums show the characteristic "lead line" and it has not disappeared, a glass of water to which ten drops of a ten per cent solution of potassium iodide has been added should be taken once a day for three to four days. By using this treatment the lead is removed from the system and it is only in very rare cases, where the patients have not paid attention to the first symptoms, that it is necessary to apply special medical treatment.

The treatment mentioned has been in effect for years in a plant where over 200,000 pounds of lead battery plates are handled per month. Previous to the adoption of this treatment, cases occurred where workers had to be sent to the hospital for medical treatment for lead poisoning, but since the treatment has been in effect these cases have practically been eliminated.

Tarnish on Copper Plate

Q.—We are copper plating hot rolled steel by the use of a copper cyanide solution, the work is rinsed with our regular tap water and immediately dried. The product at this stage is very bright and entirely satisfactory, but if this same part is left lying around for a few days, a stain is produced. This stain is not rust but discoloration, as evidenced by the sample we are sending to you under separate cover.

Any comments you may make as to how this situation may be overcome will be greatly appreciated.

A.—There are three factors that may cause the copper plated work to tarnish: First, copper that is deposited from a cyanide solution that contains a large amount of hyposulphite of soda, which is used as a brightener; second, the conditions of the atmosphere where the work is placed after plating operation; third, improper drying operations. After plating, rinse thoroughly in clean cold water, then in a soapy water solution of 1 oz. soap chips to 10 gallons of water and then in clean hot water, and finally dry in clean, hardwood sawdust. After drying operation, avoid placing work in an atmosphere that contains sulphur compounds. —O. J. SIZELOVE.

Enameling Electro-Galvanized Steel

Q.—The writer would greatly appreciate any information and suggestions that you may give him on the following subjects:

How should surface of electro-galvanized strip steel be prepared for enameling? What practice would you recommend for enameling electro-galvanized strip steel? How do you prevent peeling of enamel on electro-galvanized strip steel? For your information I am using an acid zinc bath for electro-galvanizing strip steel.

A.—You can successfully enamel your galvanized strip steel if the work is treated with a copper sulphate solution, made by dissolving 2 ozs. copper sulphate in 1 gallon of water. The work can be immersed in this solution or sponged with it and left to dry before enameling. The copper sulphate solution will cause the surface of the galvanized iron to turn black, and when the work is in this condition the enamel will adhere perfectly.

—O. J. SIZELOVE.

Cut Steel Buckle Finish

Q.—We are sending you a sample of a cut steel buckle which, we believe, has a plated finish. We should like to find out how this finish is produced. Can you give us a formula for the solution used?

A.—This is not a plated finish. The small cones or discs are made of steel, polished to a high finish, and then fastened to the brass base. This article was not made in this country.

The method used in this country is to have the buckle made of brass, polished or ball-burnished to a high lustre, and plated in an iron solution. A solution for this class of work is made as follows:

Dissolve 16 ozs. ammonium chloride in one gallon of water. Use soft cold-rolled iron for anodes and a brass or copper cathode. Electrolyze for 3 or 4 hours with 5 volts pressure. Reduce voltage to one and add 2 ozs. magnesium sulphate per gallon. Solution is then ready to produce finish desired. —O. J. SIZELOVE

The Milk in the Cocoanut

Good and Bad Advertising

By FREDERIC B. STEVENS
President, Frederic B. Stevens, Inc., Detroit, Mich.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

When you hear the not too large advertiser, glibly assert "Advertising does not pay" he uses the expression in all its glittering generality but he need not say it in Latin, French or Czechoslovakian for one to know that he means it does not pay him. Such a dire result might follow an artificial ice plant in Iceland or an anthracite coal yard in India, but in this country the disaster may be escaped.

All that is necessary is to know how to make advertising pay and when one does not know, the first thing is to find out.

Much money is wasted in miscalled advertising which is merely an attempt for popularity or possible publicity.

The numerous desk trinkets and pocket novelties are good enough as far as they go, but they do not go far enough. It was at a "Hoosier" dinner in the open, generously given to a business association, when I finished my beets, beans and artichokes, that I said to my neighboring compatriot, "Can I trade this cigar with you for a match?" He answered in the affirmative and handed me a pocket leather match holder which displayed the name, in gilt letters, of the firm that distributed them. After I had lighted my cigar I asked him if he had carried it for some time and he answered, "Yes, three or four years." I then asked him if he remembered the name of the firm which was printed on its outside. "Well," he said, "of course, I have seen it, or half-seen it, a thousand times, but, bless me, if I can remember it."

The firm that advertised in that way wasted its energy. There was advertising that didn't advertise.

Notice the evolution of the advertising calendar. First it showed a picture of Heater & Company's factory, with screws and nuts decorating the margin of each monthly calendar leaf. That factory picture was not especially decorative for an office wall and so it found its way into the remorseless waste basket. Then came the steel engraved calendar with pictures of horse racing at Sheepshead Bay and Maud S, in the foreground.

Now and then some picture variation followed and again, Washington crossed the Delaware and Eliza once more cracked the ice on the Ohio. All that took a back seat when color printing began its action and the pretty girl picture predominated. Whether she stepped in or stepped out of the automobile, we saw her and let it go at that. The early day description of the car was frequently non-understandable to the novice with never a word about how much gas per mile. More colors, with copies of famous paintings, landscapes and waterscapes and those beautiful pictures, like the pretty girl, took the eye but the advertisers name was overlooked or cheerfully forgotten. Now the calendar makers still produce works of art and marvels of color and vie with each other in size and shape, each calendar big enough for a circus poster, with no wall space sufficient, and the office boy lugs home the prize. If, perchance, one is hung up, here and there, the advertisers name is never remembered. Ask any office man when outside of his office the name of any advertiser on any calendar hung in his office and its dollars to doughnuts he cannot tell you. All this is called "Advertising" but it is hardly such. It is a happy recognition of commercial favors received and a cheerful hope for more; doubtless as reminders worth the cost, for the purpose alone. But do not expect these things to sell goods.

Salesmanship is the art, whether spoken or printed, of creating a desire, in the mind of the buyer to possess that which you have to sell. To create that desire when advertising one must first prepare that interesting proposition which the printer calls "copy."

Good copy is the whole story in a nutshell.

The Trade Journal presents the best medium for it goes to a specific class who are users or consumers of what you have to offer. There are trade journals for all the different trades so it is not difficult to select the right one. When Trade Journal advertising does not produce results, the fault is more subjective than objective. When that journal has a liberal circulation among the right trades and your "copy" is interestingly written, reasonably convincing and frequently changed, from week to week, you are reasonably sure of success.

The word "interesting" here means more than "largest," "oldest," "biggest,' and "best." These words are overworked and good reasons for their startling claims must go with them else their uses are merely "bunk" and "boloney." To attract attention a slogan or a picture at the head of the advertisement will help but the printed matter that follows must be so well and so interestingly written that the mind of the reader will be carried on from one paragraph to another before he knows it.

The slogan or the picture is the shell but the "copy" is the milk in the cocoanut. When your trade paper advertising does not pay, do not try to read your answer in the stars. Read it in your "copy."

Tobacco Rose Gold Plating

Q.—Please let me know a process for producing a dark rose gold, sometimes known as "tobacco" rose gold, on rings and pins.

I would also like to know how I can coat the green or white gold tops of rings to protect them while the shanks are being rose plated. I need a coating that will stand up in a cyanide solution that is heated to 190 to 200° F. Also, it should be easy to remove after plating is finished. I have tried the gum guaiac process but it comes off before the plating is finished.

A.—A dark rose gold or tobacco color can be produced from your regular rose gold solution by adding to it 2 ozs. ammonium chloride and 4 ozs. potassium carbonate per gallon. Use gold anodes and 6 volts at 180° F.

For a stop off to be used in a cyanide solution at 200° F. try asphaltum thinned with turpentine and dry thoroughly before plating. If this will not work, you will have to use Bakelite lacquer. This lacquer can be procured from the Bakelite Corporation, Bloomfield, New Jersey. Mix with the lacquer a small quantity of any aniline dye, paint on work, and bake at a temperature of 275° F. for 20 minutes. After plating lacquer can be removed in a boiling caustic soda solution, 4 ozs. per gallon of water.

—O. J. SIZELOVE

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

Member of Audit Bureau of Circulations and The Associated Business Papers

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ADVERTISING RATES ON APPLICATION. FORMS CLOSE THE FIRST OF THE MONTH

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Editorial

Copper Is Up

Copper is up. Since our last issue, the price of electrolytic copper has risen from 14.75 cents per pound to 15.25 cents per pound. For the first time in several years, the red metal is over 15 cents.

The reason for this rise is clear. Stocks of refined copper are down to two weeks' supply while the demand is strong. Fabricators are busy and the consuming industries seem to be poorly supplied with reserve metal. The hand-to-mouth buying policy which has served them well for several years, has in this instance, at least, created a condition which may inconvenience both producers and consumers of copper.

A 15 cent price for copper is in no sense of the word, excessive. It is even below the prices of some other commodities, comparing them with pre-war prices. Such an analogy is of little help, however, as the conditions in the copper industry are altogether different from others. In the first place the potential supplies of copper are enormous, both in the United States and abroad. New and important discoveries of copper ore have been made only within the last two or three years, such as the Greene-Cananea and the International Nickel developments. A too high price will stimulate the mining of copper to such an extent that industry cannot possibly consume it, and the result will be another glut of the market. In the second place, the cost of copper production has been decreased materially by technical improvement, both chemical and mechanical, so that the industry as a whole does not need high prices in order to earn reasonably good profits. Almost all of the important producers were doing well with copper at 14.75 cents. At prices higher than that level, their profits will be proportionally greater.

Another point of importance must not be overlooked. According to contracts which some of the producers have with their men, wages are on a sliding scale, and rise markedly when copper reaches 15 cents, 16 cents, etc. At this time there has been open talk of renewed negotiations. If these wage rises should go through, costs will rise again which may make it necessary to increase prices still more and a vicious circle may easily result. Add to this the opening up of numerous small mines which can be worked if copper goes high enough, say to 16 cents or better, and we shall have a repetition of 1919 when neither producers or consumers knew what the prices would be the following month.

Obviously this is a situation which calls for both strong and careful handling by both producers and consumers. The price of copper must not be allowed to get out of hand, for everyone will suffer and lose eventually. A fair profit for producers, reasonable prices for consumers and above all a stable market; these are absolute necessities to the copper industry.

Safety in the Metal Plants

It is the general conception that machinery of any kind and factories which use machinery are dangerous to life and limb. It is noteworthy, therefore, that according to figures compiled by the Industrial Bureau of the Merchants Association of New York, this is not necessarily the case.

It was found, in connection with an accident prevention contest conducted among 102 metal manufacturers, that a workman is safer in a machine shop than he is in a bake shop and that moving objects offer far less hazard when the power behind them is electricity or steam, than they do when propelled by human hands. It seems that "butter fingers" cause more accidents than buzz saws. Out of a total of 148 accidents, 52 were caused by falling objects or the handling of materials. Machines figured in only 25% of the accidents. Hands were less trustworthy than steel parts. Stumbling and slipping, and falling objects came next in order of trouble making after "butter fingers."

In metal manufacturing plants the accident frequency rate in the above contest was 14.39; in the food group it was 18.44; in the warehouse group where the minimum amount of machinery was involved it was 53.17.

The metal plant is far from being the most dangerous in industry. The power equipment is large and the machinery has great possibilities for doing extensive damage if something should go wrong. But such accidents are comparatively infrequent. To be sure, when they do happen they may be very serious. Undoubtedly, this is the reason why they are so rare; they are so carefully guarded against and so constantly feared.

It is common knowledge in metal manufacturing plants that most accidents are the result of carelessness. This carelessness cannot, however, be set down altogether as the fault of the men. It may also be the fault of the management which neglects to drive home to the men, unceasingly, the need for care. Machines are built to stand up. Guards are provided for moving parts. But nothing can guard against carelessness except constant warning and the proper example set by those higher up.

Cutting Circular Letter Costs

It is a little outside of our regular field to discuss advertising methods, but a new scheme has been put forward by the United States Post Office, which is important enough to call for mention even in such a highly specialized journal as our own. A large proportion of the circular letters sent out include a return postal card, for use by the prospect. This postal card costs one cent in addition to the printing, and rarely are more than five per cent returned, of the number sent out. The Post Office has developed a new system by which return postals can be printed by anyone, and returned without cost to

the sender. On all cards mailed, however, the post office will collect three cents from the person to whom cards are returned. This is, of course, two cents more than the cost of a single post card, but the aggregate cost is very low, as this three cents postage is paid only on the cards actually sent back.

This plan is so clearly a step in the right direction, saving useless expenditures and at the same time reimbursing the post office adequately for its work, that it should be adopted without delay by all organizations which use circular letters as a method of selling.

National Metal Week

A meeting will be held in Philadelphia of the Institute of Metals, together with the American Society for Steel Treating and the American Welding Society, using as headquarters the Hotel Benjamin Franklin. The Institute of Metals Division was forced to change its fall meeting, which used to be held with the American Foundrymen's Association, because the A. F. A. made changes in its own schedule, and now holds meetings in the spring. Consequently they joined with the Steel Treaters and the Welding Society in what is now called National Metal Week.

It is regrettable of course, that it was necessary for the Institute and the Foundrymen to separate, but the Institute has done well in its new connection. Last year's meeting in Chicago was both interesting and successful, and this year's meeting promises to be equally worth while. Papers will be read on copper, silver, magnesium, chromium, Britannia metal, jewelry and aluminum. The session on metallography will include papers on etching, X-rays, Brinell testing, etc.

In addition to the laboratory papers there will be papers on permanent mold casting, and vacuum casting, thus representing the operating and mechanical angles of the metal industry. In addition visitors will have the opportunity to hear papers and see the exhibits of the Steel Treaters and the Welding Society.

Attendance at this meeting should be good as the program is attractive. It will amply repay visitors for the week spent.

Sampling Solutions

In an editorial in our August issue, we brought to the attention of our readers, the new feature of our Shop Problem Department, consisting of the analysis of plating solutions in connection with the answers given to inquiries. This policy has met with unqualified approval. The plating industry realizes that chemistry has taught us how to control solutions and to eliminate guesswork.

All the large plating plants of today have their competent chemists to make chemical analyses of their solutions at stated intervals. Changes in the constituents of these solutions are thereby determined and corrections made accordingly. Smaller firms, however, cannot afford such expert help; nor are they in a position to send out for complex analyses every time they wish to check up a solution. Consequently, we have installed this service as an aid to our subscribers, not to compete with chemical laboratories but to co-operate with them and to help in the general work of educating the plating trade up to using chemical methods.

It must be borne in mind, however, that a correct sample must be taken, and this involves care. If a proper sample is not taken, results will be inaccurate and misleading. When taking a sample of the solution to be analyzed, fill the tank to solution level with water, stir thoroughly, and then fill a two-ounce bottle from the solution; cork tightly and label.

On the label should be placed such data as

1. Temperature at which solution is used.
2. Voltage and amperage, if possible.
3. Kind of anodes.
4. Area of cathode and anode surface.

Also, when possible, send a small piece of the work that has been plated. If this set of rules is adhered to as closely as possible, it will enable us to have a better view of the problem, and consequently a better answer.

Prosperity and Progress

From all reliable sources of information we are impressed with the fact that the United States as a whole is abounding with unusual prosperity for a political year. This prosperity of course, extends to the metal and plating branches of industry.

The recent statement of Alfred P. Sloan, Jr., president of the General Motors Corporation, that the year 1928 would be the best one of that great automobile manufacturing company, indicates fairly the state of affairs with manufacturers of metal products. There are of course, certain basic industries that complain, such as coal which is suffering somewhat from the competition of oil; textiles which are affected and are shifting factory locations; and agriculture, which seems to be enduring the same trouble as in 1896—overproduction. But in the main the country is forging ahead and is generally prosperous. Such a condition is attributed mainly to the wise and careful Government the country has had during the past eight years. With the election of Herbert Hoover, we can all look forward to a continuation of such an able Government, and prosperity and progress.

Government Publications

Publications listed hereunder are obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at the prices given, unless otherwise noted.

Mineral Resources of the United States in 1927. Preliminary report, published August, 1928. Prepared by the Bureau of Mines from data furnished by the Division of Mineral Statistics. Price, 20 cents.

United States Government Master Specification for Copper Nickel Alloy Castings. Federal Specifications Board Specification No. 578.

This specification was officially promulgated by the Specifications Board on June 28, 1928, for the use of the departments and independent establishments of the government in the purchase of copper nickel alloy castings. The technical requirements of this specification became mandatory for all departments and independent establishments of the Government not later than September 28, 1928. Copies may be obtained from the Federal Specifications Board, care Bureau of Standards, Washington, D. C.

Correspondence and Discussion

Purity of Nickel Chloride

To the Editor of THE METAL INDUSTRY:

In reference to the article appearing in your August issue, page 353, entitled "Excessive Chloride in Nickel Solution," we are pleased to give you below an outline of the reasons why R&H Nickel Chloride should be used in every nickel plating solution of whatever composition and for whatever purpose employed, even though Mr. Sizelove stated "Have failed to find any that did not contain large quantities of iron and copper."

Besides being one of the best conducting agents it has the following inherent advantages:

1. It causes maximum anode corrosion, thereby keeping the solution balanced better.

2. Makes possible the use of high test rolled anodes, which do not adequately reduce in ordinary solutions.

3. Most rapid rate of deposition thru increased cathode efficiency.

4. Greater throwing power of the bath, resulting in more even deposit on recessed parts.

5. Increased corrosion resistance of the deposit, due to partial control of hydrogen.

6. Avoidance of inert matter—Nickel Chloride is completely consumed during operation.

7. Controls pitting to a great extent.

In short, you are assured a better plated product, in a shorter time, at no higher cost.

A sample of our composite production recently tested showed:

Total Nickel, Ni—26.22% equal to 107.14% Nickel Chloride with "Water, $NiCl_2$ "H_2O

Total Iron, Fe 0.07%

Total Copper, Cu 0.022%

The copper content will occasionally be found to run slightly higher, but our Technical Department states that this can be guaranteed not to exceed 0.035%.

The R&H Nickel Chloride has been used for quite a number of years with universally excellent satisfaction. At various times we have received some highly enthusiastic reports in regard to results obtained, stating amongst some other facts that the firm in question was enabled to speed up their promotion quite materially, besides obtaining a deposit of higher quality than was heretofore possible.

We are at all times ready to give full information in regard to the use of our Nickel Chloride to any firm inquiring, as long as they find it convenient to give us information as to results wanted as a basis for our recommendations.

THE ROESSLER AND HASSLACHER CHEMICAL COMPANY,
New York, September 20, 1928. I. E. Weber.

A Charter Member

To the Editor of THE METAL INDUSTRY:

We have been subscribers to METAL INDUSTRY for 24 or 25 years, and you can consider this as a renewal for our subscription for next year. In the meantime send us a copy of Charles Proctors' "Plater's Wrinkles."

SCHWAAB STAMP AND SEAL COMPANY,
Milwaukee, Wis., July 24, 1928. B. W. Fueger.

New Books

Metal Statistics—1928. Published by American Metal Market, 11 Cliff Street, New York. Size, 4 x 6; 552 pages; price, $2.00.

This is the twenty-first edition of a book which is published annually. It covers a wide assortment of statistics on all the ferrous and non-ferrous metals, as well as a variety of other information which is very valuable to those who have use for the statistics. All aspects are well covered, production, consumption, shipments, prices, etc., being given for many years back. The latest edition, of course, has the 1927 figures, which have just recently been completed by such statistical authorities as the American Bureau of Metal Statistics, the Bureau of Mines and the American Iron and Steel Institute, whose figures are largely given in the book. The price data have been gathered by the publishers by daily scrutiny of the markets and the averages as well as the other statistics on prices are quite trustworthy as guides to those who wish to refer to them. The book, as in past years, is well printed and nicely bound. It is in every way a valuable book for those who need statistical information on metals.

Yellow Gold of Cripple Creek. By Harry J. Newton. Published by Nelson Publishing Company, Denver, Colorado. 128 pages, illustrated; bound in paper, 5⅜ x 7¾; price, $1.00.

A highly absorbing account of the history of the famous Colorado mining district known as Cripple Creek. Full of color and romance, the book gives all the highlights of this area's vivid tale since gold was first struck under the shadow of Pikes Peak in 1890. Interesting stories of the fortunes that were made there and of the men who made them lend the book even greater interest. It is brought down to date, with some slight prognostications as to the future of the famous gold producing district that has thus far given up over $400,000,000 worth of the precious metal.

The Behavior of Prices. By Frederick C. Mills. Published by the National Bureau of Economic Research, Inc., New York. 598 pages. Price, $7.50.

In a study of individual commodity prices and the interrelationship between these and the price system, Mr. Mills brings out a number of important points. An attempt has been made by scientists to reduce the welter of data regarding the behavior of prices to terms which can be understood easily and which will serve as media for further study of the great variety of factors which make for regularity or irregularity of prices. The fundamental importance of price trends to production and consumption of manufactures and natural products has been kept in mind by the author throughout this comprehensive work. The tendency of price changes to retard, stimulate or keep upon an even keel the volume of output of goods has been treated and general price system has been analyzed. The manner in which the system is periodically disturbed by fluctuations in prices and its regularity in recovering from such disturbances is taken into account. The wide diversity in the behavior of individual prices is shown to contain regularities which can be scientifically recognized and used for analytical purposes.

Representative Industries in the United States. Edited by H. T. Warshow. Published by Henry Holt and Company, New York. Size, 6 x 9; 702 pages. Price, $5.00.

Detailed and quite authoritative descriptions of some twenty-odd large industries of the United States are contained in this volume which is intended to give a review of the operation of the country's leading fields of work. The various chapters are written by men intimately connected with the industries of which they write, as, for example, Robert J. Anderson on the aluminum industry, A. R. Erskine on automotive production, Mr. Warshow, who is comptroller of the National Lead Company, on lead mining and smelting, J. R. Wettstein on blue lead and mixed metals, W. R. Ingalls on zinc. Each of these men must surely know their fields, and the chapters on wool, railways, construction, paint, power, rubber, meat and sundry other lines are also written by persons pre-eminently fitted for the work. Thus, the whole industrial life of the country is described and discussed; processes and methods are explained; the histories of the various fields are given. There is a vast amount of extremely interesting information in Representative Industries in the United States; and it is material with which men in industry can profitably become acquainted, since a knowledge of all lines is undoubtedly an excellent background for a specialized knowledge of a particular field.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. PETTIS, Rolling Mill; W. J. REARDON, Foundry; P. W. BLAIR, Mechanical; CHARLES H. PROCTOR, Plating Chemical

Aluminum Printers' "Furniture"

Q.—We are figuring on making aluimnum parts for the printing press trade and we find that the aluminum seems to grow. We received recently a sample block that had been in use for some time. This increased in length 25/1000 in. The piece originally was 2½ in. and ¾ in. wide.

Do you know of any alloy that we can safely guarantee not to increase or decrease in size after it has been machined? The pieces to be made are very small and must be machined very accurately; they are called "furniture" by printers.

Can you give us any information regarding the machining of this material?

A.—This point you bring up that your aluminum castings increase in length 25/1000 in 2½ inches is something we have not run into and have no data on. However, we would suggest an alloy with a low linear contraction. The alloy we would suggest is 90 aluminum and 10 silicon. This alloy has shrinkage of 0.133 per foot, is hard and should not grow. However, as we said before, we have had no experience with alloys growing in size after machining such as you state. Use kerosene oil for lubrication when machining.—W. J. R., Problem 3,786.

Bright Silver on Soft Metal

Q.—We would like to have your advice as to how we can silver plate pieces like the inclosed sample, making them bright silver without having to brush them.

A.—To bright silver plate soft metal work, it is necessary to copper plate the work long enough to stand a bright dip, or else to plate the work in a bright cyanide copper solution. A bright copper solution is made as follows:

Copper cyanide	2 ozs.
Sodium cyanide	4 ozs.
Water	1 gallon

Temperature 140° F. and 2 volts pressure.

For brightener dissolve 1 oz. lead carbonate, 4 ozs. caustic soda in 1 pint of water. Add very small quantity, probably 2 ozs., of this stock solution, to every 100 gallons of the copper plating solution. Agitate work strongly while plating.

After work has been bright copper plated or bright dipped, plate in a silver solution that contains 1 oz. of silver as metallic silver and 3 ozs. of sodium cyanide as free cyanide per gallon. It is only necessary ta plate work in this solution for a few minutes. Dry work by passing through a soap water solution made of 1 oz. soap chips to 10 gallons of water, then in clean hot water and hard wood sawdust. Finally, lacquer with a clear silver lacquer.—O. J. S., Problem 3,787.

Cadmium and Tin Solutions

Q—Please tell us if you think a whiter, cleaner and brighter finish can be obtained on nail files by plating with cadmium first and nickel over it.

We would like to have all necessary information about making up, equipment necessary, operating and maintenance of a cadmium solution. Perhaps we would need merely a thin coat of cadmium to produce the desired effect.

A.—A cadmium deposit would no doubt give your product a whiter and cleaner finish than just nickel alone. You must bear in mind that cadmium deposits oxidize, like zinc deposits, but the oxidation is whiter on cadmium than on zinc. Electro-deposits of tin have been found useful by other makers of products like yours. Tin stays white when it is properly applied and it is not susceptible to oxidation.

We can give you data on both tin and cadmium plating. Steel tanks are best for both of these solutions. They should be connected with iron steam coils so that the proper temperature can be maintained constantly.

Cadmium plating is identical with copper plating with a cyanide solution. The operations are the same. Sodium cyanide is the basic factor and its additions must be determined per gallon per day. The minimum should be ⅛ ounce per gallon per day. Solution should always be kept constant.

The following is an electro-tin solution:

Water	1 gallon
Sodium stannate	12 ozs.
Caustic potash	1 oz.
Sodium acetate	2 ozs.
Hydrogen peroxide 25 volume	1/5 to ⅛ fluid oz.

Use at temperature of 160° F., with 3 to 4 volts; anodes either pure Straits tin or equal surface areas of tin and sheet steel.

The electro-cadmium solution is as follows:

Water	1 gallon
Sodium cyanide, 90-98%	8 ozs.
Cadmium oxide	2 ozs.
Caustic potash	1 oz.
Flake hide glue	1/15 oz.

Use with 4 to 5 volts; temperature, 80 to 110° F.; amperage, 10 per square foot, minimum. To prepare the solution, use one-third of the water first at 140° F. Add the sodium cyanide, then the cadmium oxide, then the balance of the water, lukewarm, then add the caustic potash. Save a part of the water to dissolve the glue. When all is mixed in, stir the solution thoroughly and it will be ready to operate.—C. H. P., Problem 3,788.

Copper or Brass Immersion Dip

Q.—We once saw a formula in your publication which was for producing a brass color on small metal parts, such as paper fasteners, etc., which are first copper coated. We believe this was called a "Brass Wash," and that it required no electric current. Can you give us this formula?

A.—Articles that have been copper coated cannot be turned a brass color by dipping. Steel must be bright and clean to take brass or the copper; each must be produced separately, without a copper or brass color by immersion. You cannot produce them in relation to each other. After a copper or brass color is put on the articles, care must be taken to wash them thoroughly in cold and boiling waters, after which they may be tumbled in hard-wood sawdust for a short time if a bright finish is desired.

COPPER DIP

Water	1 gallon
Sulphuric acid	1 oz
Copper sulphate	2 ozs.

These proportions may be increased to 4 ozs. each per gallon, but as a rule the dilute solutions give the best results.

BRASS DIP

Water	1 gallon
Sulphuric acid	1½ oz
Copper sulphate	1½ ozs.
Tin chloride	1½ ozs.

This solution may also be strengtehned in proportion, if found desirable. Quite frequently this solution is used for tumbling the brass color on small steel articles. In such use, metallic flake tin should be used to keep the tin content of the solution constant. Flake tin is made by melting pure tin and pouring it into cold water from a height of several feet. It should be poured just after reaching the melting point and care should be taken to prevent scalding by steam produced in pouring.—C. H. P., Problem 3,789.

Improving Throwing Power of Chromium

Q.—I am sending you part of an electric socket which I have tried to chromium plate by using a method outlined some time ago in THE METAL INDUSTRY. I do not seem to be able to get the socket part covered where it attaches to the wire. I am using 150 amperes, 6 volts. Can you tell me what is wrong?

A.—There is nothing wrong with the solution for chromium plating given in our June 1928, issue, page 277, which I presume is the solution to which you refer. You must make better contacts on all articles to be chromium plated than on work to be silver, nickel or copper plated. They must be tight and large enough to carry the high amperage necessary for best results. It is possible that the sulphate factors, chromium sulphate and sulphuric acid, are just a little too high. This can be corrected by adding from four to eight ounces of chromic acid to each gallon of your present solution. You might also reduce the steel anode surface and add two small lead anodes. Following these suggestions may help to increase the throwing power of your bath. As a rule, however, imperfect contacts are the chief cause of imperfect covering. Minute amounts of carbonate of barium can also be added to chromic acid solutions when there is an excess of sulphates. The carbonate of barium neutralizes the sulphates and forms insoluble barium sulphate which goes to the bottom of the chromium solution and does no harm.

Do not add more than ⅛ oz. of barium carbonate per gallon of solution at any one time, and stir the material thoroughly into the chromium solution.—C. H. P., Problem 3,790.

Old English Burnt Brass

Q.—We are sending under separate cover a section of a cast iron side of one of our gas stoves, showing approximately the style and color of finish we want to plate on this piece. The plated finish shown was produced by first plating with brass, then plating over that a coat of copper, just heavy enough to stand the oxidizing solution of liver of sulphur. The casting was then brushed to make the smooth brown tone and then the oxidizing and copper were buffed through to show the brass. This, of course, requires a good many handlings and on a production job it is difficult to have the work come uniform due to the fact that the workmen do not always get the work buffed cleanly down to the brass or else they buff through the brass taking the plate off down to the bare iron.

What we want to know is whether you know of a formula for oxidizing a brown shade directly on the brass plate, or a soft bronze or brown plate which can be put on the brass which can be easily buffed through to the brass, which would eliminate the copper plating and oxidizing which we now do to produce the finish shown by sample casting. The finish could show a deeper brown than the sample, which is a little on the red shade.

A.—The finish you desire is called "Old English Burnt Brass" and also "Old Spanish Brass." The procedure you outline in production of this finish, which you say involves too many operations, is used by other firms in your line of business. However, we suggest that you try the following method:

SOLUTION NO. 1

Aqua ammonia, 26°	1 gallon
Red sulphide of antimony	8 ozs.

Heat in stoneware crocks surrounded by hot water to 140 to 160 degrees Fahrenheit.

SOLUTION NO. 2

Water	1 gallon
Sodium chlorate	4 ozs.
Copper sulphate	1 oz.

Prepare in same manner as outlined above for Solution No. 1. The brass plated iron or steel parts should be cleansed as usual. Immerse them in boiling water, then immediately in Solution No. 2. After a moment or two, during which the brass will assume a greenish bronze color, rinse in cold water first, then in hot water. Next, immerse in Solution No. 1 for a few moments until the desired tone is obtained. Then rinse in separate hot water kept for the purpose. The antimony and ammonia which comes off the articles in this last rinse, acts as the final toning dip for the brown finish. Next, wash in a final hot water rinse and dry out. Relieve as desired with soft buffs, then cleanse and, finally, lacquer. Naturally, the operations appear numerous, but perhaps they may be modified to some extent to suit your product. We should be pleased to know the results you obtain.—C. H. P., Problem 3,791.

Pores in Red Brass

Q.—At times we have trouble with our red brass and ornamental bronze on fine work with porous surface and fine holes. We believe this trouble is oftentimes caused by sulphur as we use all new metal on such work and take every precaution. We are melting brass in coke furnaces and the analysis of our coke is as follows:

Moisture	2.58
Voluble	1.19
Fixed carbon	91.13
Ash	7.68
Sulphur	0.53

Do you think the coke we use has anything to do with our trouble?

A.—The analysis of your coke is very good and you can rest assured your trouble is not due to the coke, as coke with less than 0.75 sulphur is very acceptable to the trade. What I would suggest is that you put all the metal in the crucible and not leave it on top of the coke, as very often melters will do to hurry up the heat. They will place an ingot of metal around the pot on top of the coke and in doing this the metal absorbs the sulphur from the coke and causes porous surfaces and fine holes such as you state.—W. J. R., Problem 3,792.

Questions on Equipment

Q.—While making a new layout of our plating department, the following questions have come up on which we would like your opinion:

Which is the most efficient and practical installation, bus bars or cable?

What type of floor do you recommend for a plating department?

Will the fumes be injurious to a motor generator set and would it be better to place the set outside the department and thus carry the current the added distance?

A.—The most efficient and practical installation for plating room conductors are bus bars or heavy copper strip.

The best type of plating room floor, if it is possible to lay it, is this: Four inches of concrete covered with 2 inches or less of Barrett's Asphaltum Mastic, which is applied molten. Then a layer of acidproof brick, laid either horizontally or vertically, with spaces at ¼ in. between bricks. The spaces are filled with more molten Asphaltum Mastic. This combination will make a plating room floor which should never have to be replaced.

Always locate plating generators where they will not come in contact with plating room fumes because the moisture and gases are never beneficial and are sometimes harmful. You can keep the generator inside the plating department by building an enclosure around it of large window frames to protect it from gases and moisture.—C. H. P., Problem 3,793.

Removing Fused Borax

Q.—We would like to know if you can recommend a pickle that will satisfactorily remove fused borax flux from the outside of thin nickel silver sheets. We make a small hollow handle out of nickel silver .020 in thickness and braze these two pieces together, using powdered borax as a flux for the silver solder. The surplus borax remains sticking to the outside of the soldered piece and we have great difficulty in removing it. We have tried boiling in hot water without success. Any suggestions that you have to offer will be greatly appreciated.

We would also like a formula for a satisfactory bright dip for 10 per cent nickel silver.

A.—You can remove the fused borax from your work by placing it in a hot 20 per cent solution of sulphuric acid. To dip same bright, when work comes from this pickle, place directly in a burn-off dip, used hot, and made as follows:

Nitric acid	1 part
Sulphuric acid	2 parts
Water	10 parts

Rinse work in cold water and then pass through the regular bright dip composed of 2 parts sulphuric acid, 1 part nitric acid, and 1 oz. hydrochloric acid to every 10 gallons of bright dip.—O. J. S., Problem 3,794.

Patents

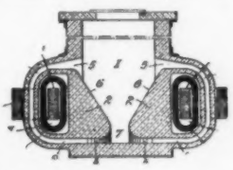
A REVIEW OF CURRENT PATENTS OF INTEREST

1,675,798. July 3, 1928. **Alloy and Process for Making Same.** Russell Franks, Brooklyn, and Buyrnham E. Field, Douglaston, N. Y., assignors to Haynes Stellite Company, a Corporation of Indiana.

An alloy containing from 3 to 5 per cent aluminum, 3.5 to 6 per cent silicon, 5 to 12 per cent tungsten, 6 to 12 per cent zirconium, boron in substantial and effective amounts up to 1 per cent, the balance being principally nickel.

1,674,954-1,674,959 inclusive. June 26, 1928. **Methods and Processes Relating to the Hardening and Working of Lead Alloys.** Reginald Scott Dean and William Ewart Hudson, Oak Park, Ill., assignors to Western Electric Company, Inc., New York.

1,676,545. July 10, 1928. **Induction Furnace.** Reinhold Gross, Hohenneuendorf, near Berlin, Germany, assignor to Siemens & Halske, Aktiengesellschaft, Siemensstadt, Germany.



An induction furnace comprising in combination, a hearth, a transformer core, a channel surrounded by the transformer core and communicating on the one hand with the bottom of said hearth and on the other hand with a point vertically above the bottom opening, and an inclined hearth wall between the openings of said channel whereby the cross-section of said hearth is reduced toward the bottom.

1,676,709. July 10, 1928. **Process for Determining the Composition of Copper and Zinc Alloys.** Michael Polanyi, Berlin-Zehlendorf Mitte, and Stephan von Bogdandy, Berlin-Dahlem, Germany.

A process for determining the composition of alloys of copper and zinc, consisting in weighing a portion of the alloy to be treated, subjecting said weighed portion to the action of heat in a vacuum until all the zinc contained in said alloy is volatilized, and weighing the remaining metal.

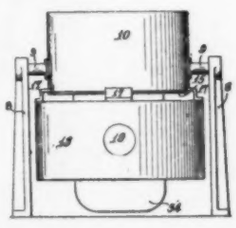
1,676,856. July 10, 1928. **Alloy.** Alfred George Cooper Gwyer and Henry Wilfred Lewis Phillips, London, England, assignors to The British Aluminum Company, Limited, London, England.

The method which consists in the addition to a molten alloy containing at least about 6 per cent of copper and at least about 50 per cent of aluminium of about 0.1 to 0.3 per cent of an alkaline earth metal.

1,676,949. July 10, 1928. **Method of Soldering Leading-In Wires to Lamp Bases.** John Joseph Higgins, East Orange, N. J., assignor to Westinghouse Lamp. Co.

The method of soldering leading-in wire to a base which comprises bending a leading-in wire to form a loop, drilling a hole in said base, positioning said loop in said hole, inserting an end of a rod of fusible material into said hole and in contact with said loop, severing said rod to permit a short section thereof to project from said hole, moving a heated member to fuse said section and positioning the lamp so as to permit a flow of the fused material along a portion of the length of said leading-in wire.

1,677,528. July 17, 1928. **Rotary-Field Induction Furnace.** Edwin F. Northrup, Princeton, N. J., assignor to The Ajax Metal Company, Philadelphia, Pa.



In operating an induction furnace having a pool and molten metal resistors within channels connected at the bottom beneath the pool and connected with the pool, the method which consists in utilizing a surrounding rotary induction field to induce current within the resistors and using the resultant torque upon the resistors to drive the metal against the channel walls so as to cause circulation along the lengths of the resistors.

1,677,667. July 17, 1928. **Treatment of Magnesium and Magnesium Alloys to Inhibit Corrosion.** Arthur C. Zimmerman, Dayton, Ohio.

The method of treating magnesium and magnesium base alloys to inhibit corrosion which consists of treating the metal with a solution of phosphoric acid until a protective coating of magnesium phosphate is formed on the surface of the metal.

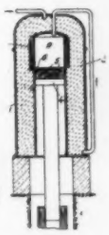
1,678,770. July 31, 1928. **Tank.** Charles P. Eisenhauer, Dayton, Ohio, assignor to Duro Company, Dayton, O.

In a method of manufacturing tanks, attaching a grating to the inside flange of the end of a tank, inserting the grating and end within one end of the tank, attaching the end to the tank, galvanizing the tank and end.

1,678,776. July 31, 1928. **Metal Pickling.** James H. Gravell and Alfred Douty, Elkins Park, Pa.

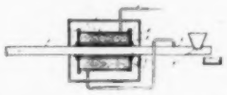
An acid pickling bath for metal containing stannous tin in limited quantity substantially as described sufficient to selectively control the bath and insufficient to cause the bath to dissolve scale.

1,678,875. July 31, 1928. **Electric Bright Annealing Furnace.** Wilhelm Rohn, Hanau-on-the-Main, Germany, assignor to Siemens-Schuckertwerke Gesellschaft mit beschränkter Haftung, Siemensstadt, near Berlin, Germany.



In an electric bright annealing furnace, in combination, an elongated airtight furnace shell closed at the top and open at the bottom and filled with a protective gas during the annealing operation, a refractory lining within said shell, electric heating means in the upper portion only of said shell, and means for introducing the goods to be annealed into said shell from the bottom.

1,678,876. July 31, 1928. **Electric Bright-Annealing Frunace for Continuously Bright Annealing.** Wilhelm Rohn, Hanau-on-the-Main, Germany, assignor to Siemens-Schuckertwerke Gesellschaft mit beschränkter Haftung, Siemensstadt.



In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process.

1,678,980. July 31, 1928. **Protective Coating for Metal and the Like.** John B. W. Gardiner, New York, N. Y.

The method of coating materials which comprises the steps of applying to the surface of a material a layer of bituminous emulsion formed without the use of soap and covering such bituminous emulsion with a layer of dry cement while the emulsion is still wet, whereby water is drawn from the emulsion and the cement is hydrated to form a protective coating for the bituminous material and the surface of the bituminous material and the cement are caused to intimately unite and cohere.

4. A product as specified in claim 3, in which said base is metal.

1,679,002. July 31, 1928. **Welding Electrodes.** Norman B. Pilling, Elizabeth, and John G. Schoener, Bayonne, N. J., assignors to The International Nickel Company, New York.

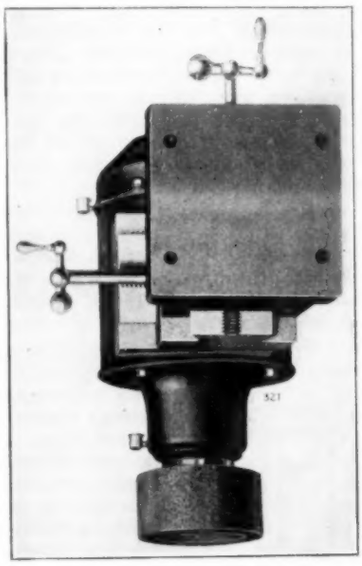
An arc welding electrode comprising a normal nickel alloy, and a coating in which there is approximately 19 per cent titanium, and approximately 6 per cent calcium.

Equipment

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

Vertical Spindle Grinders

The Hisey-Wolf Machine Company, Cincinnati, Ohio, has placed on the market three new types of vertical spindle grinders, one of which is shown in the accompanying illustration. This is the vertical spindle grinder with double slide adjustment. The makers state that the new apparatus can also be supplied with single horizontal slide adjustment or with single vertical slide adjustment, as desired.



VERTICAL SPINDLE GRINDER

The vertical spindle grinders are made in 1, 2 and 5 horsepower sizes for alternating current, and in 3 horsepower size for direct current operation.

The makers state that these machines are primarily constructed for thrust grinding with the spindle in horizontal position or with the grinding wheel slung down at any angle. The bearings are constantly lubricated in an oil bath and fully enclosed in leak-proof chambers. When used in connection with a boring mill, many internal and surface grinding jobs can be done, it is stated, with one setting. While affording tool room accuracy, the grinders are ruggedly constructed for general production work.

The standard slide adjustment is the single horizontal type on these machines, while the vertical adjustment and the double adjustment are provided to order by arrangement with the manufacturer. Special ball bearing construction throughout is another feature of these machines.

Chromium Plated Zinc Sheets

A new sheet metal, which the makers claim to be of far reaching industrial importance, as it offers to manufacturers chromium finish on a non-ferrous base for the first time, has been developed by the Apollo Metal Works of La Salle, Illinois, and is being marketed under the trade name of "Apollo Chrom." "Apollo Chrom," according to the manufacturers, combines the platinum-like appearance of chromium with the easy adaptability of zinc to practically all requirements that call for specially surfaced sheets it is stated. It is offered as the means of bringing chromium within the reach of metal users who require the qualities of chromium in their product but who wish to avoid the expense and delays of plating.

"Apollo Chrom," it is stated, is manufactured by a process that combines zinc, nickel and chromium in such proportions that for stamping, spinning and deep drawing the sheet should be handled with the same procedure as sheet zinc, though its range of usefulness is indefinitely extended by virtue of the durable surface. Its ductility is comparable to sheet zinc, as is also its hardness and heat resistance, it is claimed.

Without injury to the surface the sheet can be stamped into intricate shapes in either large or small dimensions, though dies designed for brass or copper must occasionally be modified to cope with the requirements of the zinc base, the makers state. In spinning, the stretching of the surface does not impair the quality of the chromium to the extent that spinning impairs a nickel surface. A job spun from "Apollo Chrom," it is claimed, surpasses in luster the quality of work capable of being done on nickel plated steel. By eliminating friction on the dies through the chromium surface, the sheet stamps easier than steel, brass or copper, according to the description.

The resistance of chromium to alkalies and corrosion is so well known that it is already a by-word among metal users, yet the Apollo Metal Works states that, inasmuch as it is impossible to duplicate in a laboratory the innumerable conditions under which corrosion can take place, it is impossible to say definitely what is the extent of corrosion resistance embodied in "Apollo Chrom." For this reason the manufacturers are willing to supply samples to all who are interested in adapting this sheet to finished articles.

The makers have countenanced the inevitable trend to better finishes that are being demanded by metal users in all lines; and at the same time they have sought to keep down the costs of making better articles by eliminating the necessity of chromium plating individual parts. The fact that "Apollo Chrom" contains no ferrous material makes it doubly valuable as a material that holds its original appearance indefinitely, they state.

The cost in comparison with other metals that are now being used makes it especially interesting, they claim. Barring the fact that it is more satisfactory to stamp parts directly from specially finished sheets, a manufacturer who employs "Apollo Chrom" avoids the additional cost of plating and polishing, it is claimed.

"Apollo Chrom" is measured on the zinc gauge and is produced in all gauges from No. 4 to No. 20. The base sheet is 36 x 84 inches, and the makers can turn out sheets as large as 44 x 108 inches. They also supply strips 84 inches long in any width. Material is furnished with chromium on either one or both sides.

In 1915, The Apollo Metal Works was organized by the late Henry Schuessler for the purpose of supplying industry with specially finished raw material. Its "Apollo-Nickel Zinc" has been used widely by manufacturers of stamped parts for automobiles and has also been incorporated in leading washing machines, refrigerators, clocks, radios, electrical devices and in many lines that require a surface of outstanding beauty. The addition of "Apollo Chrom" extends the field of specially finished sheets. The general offices of the Apollo Metal Works are located with its sheet mill, at La Salle, Illinois. A coil mill is located at Bethlehem, Pennsylvania. Sales offices are located in the larger cities of the United States and Canada.

Centrifugal Dryer

Simplicity of design and sturdy construction are among the advantages claimed by A. M. Dellinger, 723 North Prince Street, Lancaster, Pa., for the Kreider centrifugal dryer, which that firm has placed on the market. The makers state that centrifugal dryers are indispensible to platers and other finishers who need to dry out metal parts rapidly in order to keep costs of operation low. In regard to the Kreider dryer, it is stated that its operating principle is simple and practical. The articles to be dried are put into the basket and rinsed in hot water. The lid is put on and the basket placed in the machine. Power is then turned on and the basket revolves at a high speed, causing the liquid to be thrown off of the articles and drying them almost immediately. No sawdust is needed. The basket is completely enclosed in a case which catches

CENTRIFUGAL DRYER

and retains the liquid, thus preventing waste (if lacquer is being used) and disorder from liquid flying about.

The Kreider dryer may be set up in a 14 x 33 inch space.

Other advantages claimed for the Kreider dryer are: lacquered articles will not stick together and lacquer will not lump; articles need not be heated before drying; causes no dirt or disorder; runs at 550 r.p.m. on low power; one or two man operation; guaranteed against defects for one year.

Electric Heat Treating Furnace

As a result of new development, the Harold E. Trent Company, Philadelphia, Pa., has placed on the market a line of pot type heat treating furnaces suitable for lead, salts and cyanide. A number of the features claimed for this apparatus are visible in the illustration, which shows the style of the PF-300 and PF-500 sizes. The relatively small diameter or space occupied by the furnace without any increase in temperature of the furnace casing, is said to cause very low heat radiation loss. Another physical feature is that the cover lifts away from the pot in two halves by means of counter balance weights, with no interference between cover and thermo couple. The terminal boxes are arranged for single, two, or three phase, according to the size of the pot and the customers' requirements and for voltages of 110, 220 and 440. The crucible is made of high temperature alloys and, although the equipment is not recommended for higher temperatures than 1700°, it has been used up to 1950° in the crucible without deterioration, it is claimed.

HEAT TREATING FURNACE

The crucible is suspended on a casting partially imbedded in the furnace above the refractories, so that radiation losses are not increased by any heavy exposed metal on the surface of the pot.

The heating element occupies an annular cavity; the distance from the wall of the insulator to the wall of the crucible is not more than 1-¼ in. The heating element is supported upon molded insulators interlocked into position and the back filled in behind the insulator with a high grade insulating powder. The element is rigid in its vertical members, but flexible to form around the inside of the furnace. The terminals are of strip nichrome welded to the unit. It is stated that a heating element can be placed in a PF-100 furnace in twenty minutes. The design of the heating element has resulted in a cutting down of the annular cavity around the crucible and this in turn has reduced the overall diameter.

New Type Cooling Fan

The Coppus Engineering Corporation, Worcester, Mass., has placed on the market a new type of fan designed for use in industrial plants where hot work is performed. The apparatus is known as the "Coppus Heat Killer." In another form it is styled the "Coppus Manhole Blower." These are practically the some, one having a tripod stand on which the blower is mounted for use in factory rooms where cooling draughts of air are needed to keep operators comfortable, the other having no tripod but being equipped to attach to manholes of boilers and similar places which need to be cooled during inspection, repairing or cleaning.

The fan has a long, horn-shaped diffuser by means of which the blast of cool air can be directed to any point. By changing the distance between the fan and the area to be cooled, either a strong, concentrated draught or a wide, diffused breeze can be thrown in any direction. The makers claim that the efficiency of workers is greatly increased by cooling the atmosphere in which they work. The fan is operated by a half-horsepower General Electric universal motor, for direct or alternating current, any number of cycles. The apparatus is recommended for foundries, casting shops, heat treating plants, power plants, etc.

New Chromium Polish

The successful finishing of an electro-deposit is just as important as the plating itself. The extreme hardness of chromium and the fact that chromium plated work does not come from the bath in a highly finished state makes it necessary to color or buff such work wholly or in part. This insures a uniform appearance to the finished work, and at times saves the expense of replating.

An electroplated chroium deposit cannot be buffed with the ordinary nickel polish, therefore a demand has been created for a polish that will do this work quickly and satisfactorily at a low cost. Lasalco Inc., of St. Louis, whose reputation for high grade compositions is well known, after a careful study of conditions and a series of experiments have developed a polish which, it is claimed, will color and buff chromium to a lustrous finish. This polish, known as "Chrombrite," is a special composition which is manufactured in two grades, one for a light cut or for coloring, and the other for heavy cutting and for buffing. The manufacturers state that samples of this polish may be had gratis, and prices will be quoted on application to them at 2828 La Salle Street, St. Louis.

Demonstrations of Tobin Bronze Welding

Sparks will fly in Booth 97 during the week of the National Metal Exposition at Philadelphia, October 8-12. This space has been reserved by The American Brass Company and will be the scene of practical welding tests during the exposition.

A complete line of Anaconda copper alloy welding rods will be on display, together with a representative line of various cast iron and steel pieces successfully welded with these rods. The rods have been developed through extensive study and research, in order to meet the growing demand for filler rods which flow freely at relatively low temperatures and form strong, tough, satisfactory bonds, the makers state.

Tobin bronze will be featured at this exhibit and a welding demonstration, under the direction of Charles Gallo, an experienced welder, will enable visitors to watch at close range the flowing of various Anaconda welding rods. These include, in addition to Tobin bronze: managanese bronze, brazing metal, deoxidized copper, electrolytic copper, A. B. naval, phosphor bronze, "Everdur" and "Ambrac." The following representatives of The American Brass Company will be in attendance at Booth 97 during the Exposition: W. H. Dowd, W. C. Swift, W. J. MacLean, John Becht, G. M. Hurlbut, J. H. Larmett, C. M. Saltsman and D. E. Hotchkiss.

Respirator for Chromium Fumes

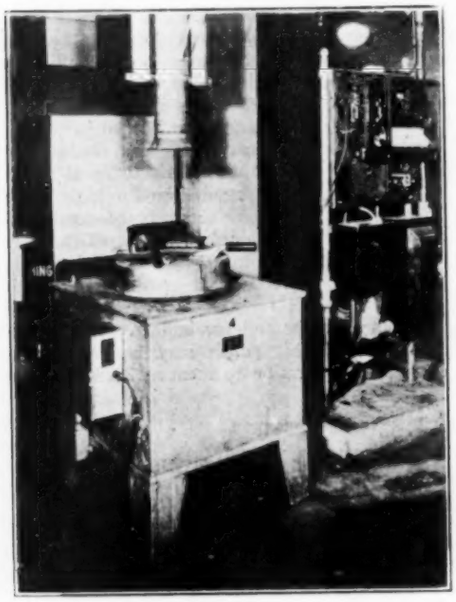
The Chicago Eye Shield Company, 2300 Warren Avenue, Chicago, Illinois, has developed a new respirator designed for protection from fumes encountered in chromium plating. It is known as the "Cesco Style 77" chemical cartridge respirator and the makers claim it gives complete protection in all plating work. The mask is made of aluminum, with a molded rubber cushion which comes in contact with the face. Adjustable elastic head-bands keep it in place. All inhaled air passes through a chemical cartridge where it is automatically cleansed of impurities. This cartridge is held in place by a screw cap and can easily be replaced when it has lost its efficiency. An extra cartridge is furnished with each mask and additional cartridges may be had at slight cost, it is stated.

Exhaled air is immediately released through a flutter valve. This feature keeps the mask cool upon the wearer's face at all times. The mask has been thoroughly tested in chromium plating work in various plants in Chicago and some firms have voluntarily offered to recommend the mask for this type of work, the makers state.

Electric Pot Furnaces

An interesting line of industrial electric pot furnaces for melting soft metals, at temperatures ranging up to the neighborhood of 1600 degrees Fahrenheit, is being manufactured and marketed by The Sentry Company, Taunton, Mass., makers of furnaces and ovens for melting and heat treating metals. The company's Model L furnace is typical of the mine of melting equipment made, and the makers claim for it the advantages of reliability and economy.

The Model L furnaces made by The Sentry Company are cylindrical in shape. The following description is given: The furnace has a nichrome heating element which is wound in a double helix.



ELECTRIC POT FURNACE

The inner and outer coils are staggered to give the effect of a solid wall or heating surface radiating heat directly to the pot.

Large radiation surface is obtained and its proximity to the pot means that the heating element is very little hotter than the pot, with consequent increased life.

Recently the makers have been using "Globar" heating elements to melt metals at higher temperatures. They have been negotiating with several companies on brass melting furnaces of capacities up to 800 pounds, but as yet nothing definite has materialized. They have built quite a number of large box type furnaces and some small "Globar" melting furnaces.

In the Model L, two semi-circular cover sections are hinged to the top plate on separate axes by a ball and socket joint. Sections are dovetailed along the center line to reduce heat loss in the closed position. The thermocouple is located adjacent to the side of the pot and is attached to the top plate of the furnace so as not to interfere with the cover or the operator. Full 9 inch thick insulating wall reduces heat loss and gives economy of operation. Heavy steel plate shell clamped between top and bottom plates of grey cast iron gives extremely rugged construction in the furnace casing.

The alloy drain tube located in the center of the refractory catch basin is so arranged that any leakage which may occur from the pot will be poured over the lip down the center of the tube. This drain tube is extended to the bottom of the furnace and by heat conduction maintains a temperature that will not allow leakage to chill, thereby preventing accumulation in the drain which would cause flooding of the furnace chamber. The use of an automatic temperature control in conjunction with Sentry furnaces, gives maximum efficiency and uniformity with minimum effort.

In the illustration is shown a furnace specially designed to meet the needs of a research laboratory, the Bell Telephone Laboratories, which is capable of operating at temperatures up to 2400 degrees Fahrenheit. This furnace has been arranged so that a crucible can be inserted for melting metals at high temperatures, or a pot for lower temperatures. Without a crucible it can be used as a pit type, high speed steel hardening furnace. The furnace is thus capable of performing a wide variety of work in the laboratory, and the makers state that it has been found quite satisfactory for melting metals and for other high temperature work.

Bearing Bronze

Fredericksen Company, Saginaw, Mich., is producing a line of bronze bearing metals designed for various uses where bronze bearings are suitable, for which the makers claim certain outstanding advantages. The metal, known as "Sabeco," is a copper-tin-lead alloy containing a high percentage of lead. The alloy is said to be produced entirely from virgin metals, insuring freedom from impurities. Perfected methods of alloying, it is stated, make for more than merely a mechanical mixture, and no segregation is discernible, according to the producers. Due to its composition a minimum of lubrication is necessary and the metal is recommended by the makers for application where lubrication is difficult.

The makers claim, furthermore, that the alloy is practically free from seizing or scoring the shafts or spindles with which it is used, even in cases where the bearing is operated dry. Frictional losses are greatly reduced. The alloy is said to be particularly adapted for gearing, especially worm gears, as it does not flake or pick up during operation.

The metal is produced in four forms, ingots, stock bars, rough castings and machined production bushings. Each form can be had in four different grades of alloy: No. 5 for ordinary machine tools; No. 9 for heavier machine tools, high speed machine tools and for grinders; No. 9H for heavy high speed machine tools and for heavy grinders; No. 11H for worm wheels and for exceptional machine tool conditions.

The alloy melts at 1840° F. and pours most satisfactorily at about 2150° F., according to the makers. Due to its intial metallurgical stability, it is stated, it can be remelted and cast without the loss or segregation of any of its elements.

Westinghouse to Exhibit at Expositon

The Westinghouse Electric and Manufacturing Company will exhibit from both the arc welding section and the industrial heating section at the National Metal Exposition to be held in Philadelphia, October 8th to 12th, 1928.

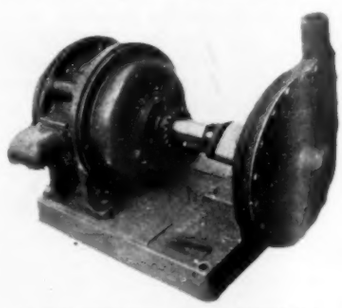
The arc welding section will exhibit a complete line of welding equipment, including the 200, 300, and 400 ampere arc welding sets. One of the sets will be demonstrated in a novel manner. The representatives of the arc welding section who will be present are: W. W. Reddie, A. M. Candy, and N. M. Norberg.

The industrial heating section will exhibit an electric furnace for lead or salt baths, with a section cut away to show the interior construction. A match vending novelty operated by a grid glow tube and a delineascope showing installations of Westinghouse furnaces, together with operating and production data, will also be displayed by the section. The representatives for the industrial heating section will be: T. C. Kelley, J. C. Woodson, F. G. Allen, C. W. Babcock, J. F. Baker, H. C. Bostwick and L. C. Schweitzer.

Rubber Acid-Resisting Pumps

The Bingham Pump Company, Portland, Ore., has placed on the market a line of hard rubber, acid-resisting pumps for which it claims certain advantages.

The pumps are made entirely of hard rubber which is molded in polished steel dies and finished by machine and hand. The shaft is of Monel metal. Thus the pump differs from other acid-resisting equipment which is made of metal with rubber lining. The impeller as well as the whole case is made of hard rubber. The pumps are of the side suction, enclosed impeller type and have been found to show high efficiency in handling all acids with the exception of concentrated sulphuric acid. Mild solutions of sulphuric acid can be handled by this pump without deterioration of the apparatus. One of the pumps is shown in the accompanying illustration.

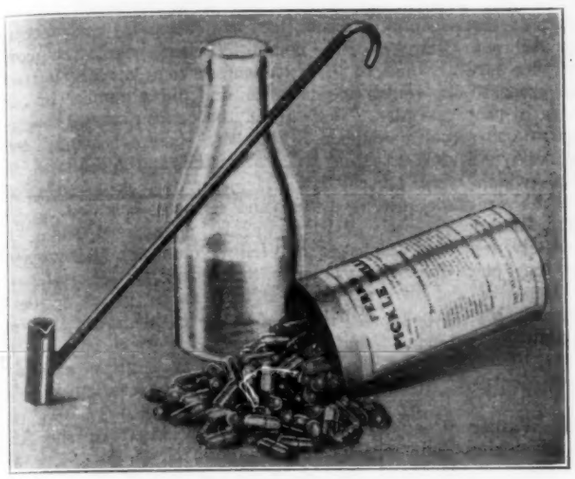


HARD RUBBER, ACID-RESISTING PUMP

There are five sizes which range in capacity from 50 g. p. m. to 300 g. p. m.

Strength Tests for Pickling Baths

Test pills, by means of which baths used in pickling, neutralizing and cleaning may be tested for strength, are manufactured by the Weaver Brothers Company, Clinton, Mich., makers of a wide variety of pickling equipment. This product, known as "Ferro Pickle Pills," provides an easy means of finding acid and alkali contents of solutions, according to the company. They are particularly useful to the plater and finisher working without



PICKLE AND CLEANER TESTING OUTFIT

laboratory, and also to operators who cannot test their baths in other ways. It is claimed that a fairly accurate analysis can be performed. The "pills" are small capsules filled with the proper ingredients to test a given type of solution. A dipper is provided with which the operator can easily withdraw a definite amount of the fluid to be tested. This is placed in a glass bottle, a pill is dropped in, and the solution turns red. Succeeding pills are supposed to turn the red liquid green, and the number of pills required to turn it from red to green indicates the acid or alkaline content, in ounces per gallon, or in percentage. There are different pills for acid and alkaline solutions. A testing outfit is shown in the illustration.

The company has on the market, as stated above, a line of pickling baskets. These are made of Monel metal and for which the makers claim certain outstanding qualities. The company states that it has adopted Monel metal as material for pickling baskets because of the non-corrosive properties of the metal, which withstands acids, and also because of its toughness and ability to stand up well under constant use, regardless of conditions. The baskets are stated to be of light weight, easy to handle and designed in a wide variety of standard shapes and sizes so that users can find proper equipment for any class of work. Produced on a quantity production basis, the company is enabled to make these baskets economically, which is reflected in their cost to users. The baskets are made rectangular and round shapes, high and low, square, oblong and in a variety of types of construction. There are some of Monel metal mesh wire, of flat strip, of thin bars, and of perforated sheets; furthermore, the types of handles vary also. They are made for manual manipulation as well as for mechanical lifting and lowering. There are special designs for hollow ware, for small parts, for large, flat shapes, for rough parts which can be dumped rapidly, and in other styles.

Electrical CO_2 Recorder

The Uehling Instrument Company, Paterson, N. J., is marketing an instrument for measuring and controlling the waste fuel which passes out of smoke stacks with other gases. The apparatus, known as the "Electrically Operated Apex CO_2 Recorder," indicates the proper air supply needed for complete combustion of fuel used in firing steam boilers. It is claimed that by its use a considerable saving in fuel can be effected, the instrument being so designed as to indicate the air supply needed regardless of changing load conditions in fire boxes. It aids in the detection of burnt-out spots in fuel beds, which can then be covered up by the fireman, it is stated, and, as these are known to be an important cause of the fuel waste, economy is effected.

The company states that the design of its instruments is based upon thirty years' experience in this field and that all efforts have been made to simplify and improve its products. One of the features claimed for the company's CO_2 recorder is that it requires less than ten minutes' attention per week to keep it in good operating condition. It is stated that no chemical solutions are used, the CO_2 being absorbed in dry cartridges.

Wood for Pattern Making

Many different kinds of wood can be used for making patterns, but the lumber most generally used, and which has the greatest all around utility, is northern white pine. Other pines, maple, mahogany can be used for certain specific purposes, however.

Wood for patterns must be thoroughly dried out, free from sap and of the kind that does not absorb moisture and subsequently warp. Recently, the sugar pine has been recommended in some quarters for pattern use. It is cheap and in many ways suitable, but it is likely to be a little sappy and cause trouble in planing and working up into shape because of rough spots, according to literature published by the Thomas E. Coale Lumber Company, Philadelphia, Pa., which specializes in pattern lumber.

Spruce is not nearly as free from knots as pine and it has a much harsher grain. Poplar is inclined to be gritty and warps badly. Hemlock is brittle, knotty and splinters easily. It also warps and splits readily. Its price is very low, however, and for some types of large rough work it may be suitable.

Redwood has a closer grain than pine but not so coarse as hemlock. It is not as durable as pine. Cypress is a cheap wood which can be used if only one casting of large size is required, because of the saving in cost. Mahogany is probably the best wood for patterns, being hard, easily worked, impervious to the moisture of sand and very fine grained. It is, however, expensive. Cherry is a little more difficult to work than mahogany, requiring five to ten per cent more labor, but is sufficiently cheaper to equalize the pattern cost.

Equipment and Supply Catalogs

The Denham Costfinder for General Managers. The Denham Costfinding Company, 2340 Euclid Avenue, Cleveland, Ohio.

General Electric Company, Schenectady, N. Y., publications: General-purpose Synchronous Motors; Automatic Welding Head and Control.

How Powdered Coal Stands Today. Combustion Engineering Corporation, New York City. An article by Henry Kreisinger, research engineer.

Spiegeleisen. The New Jersey Zinc Company, New York City. Technical data on an important ferrous alloy, nicely arranged on note-book size pages.

Polishing and Drying-Out Machines. Smith, Richardson Company, 40 Dunham Street, Attleboro, Mass. Well illustrated catalog of interesting equipment.

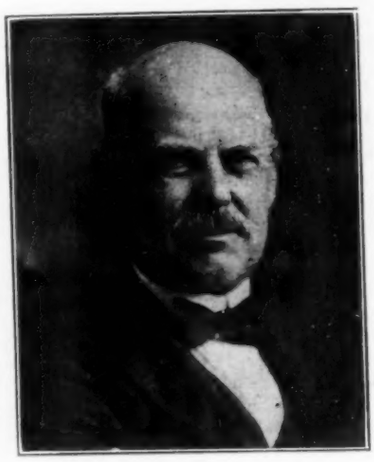
The Most Efficient Drive in Industry. Electric Machinery Manufacturing Company, Minneapolis, Minn. A large, well illustrated book on synchronous motors. The book was prepared because this company felt there was a need for a simple text on the subject as a whole, including the application and advantages of synchronous motors. The book has 56 pages, with 85 illustrations.

Resistance Thermometers. Leeds and Northrup Company, Philadelphia, Pa., Catalog No. 80, illustrated. The very interesting book shows a great variety of the company's installations and equipments for temperature measurement by the electrical resistance method. Recorders and controllers are also shown and fully described. Discussions are included of resistance thermometers in general as well as of the company's products. A part is devoted to selection of equipment and to the advantages of the "L & N Wheatstone Bridge" method of controlling, recording and indicating temperatures.

Personals

Edward Goodrich Acheson

At the 54th Convention of the American Electrochemical Society, just held at Charleston, W. Va., Dr. Edward Goodrich Acheson, known the world over for his electric furnace products, presented to the society the sum of $25,000 as a trust fund to form the basis of an award every second year of a gold medal and a prize of $1,000 to a man who has made a distinguished contribution to any of the branches of science fostered by the American Electrochemical Society.



EDWARD G. ACHESON

Dr. Acheson was born on March 9, 1856, at Washington, Pa., where his grandfather, coming from Ireland, settled in 1788. In 1880 Dr. Acheson entered the employ of Thomas A. Edison at Menlo Park, N. J., then a "fountain head of chemical knowledge and experiment." His first position was that of assistant draftsman under John Kruesi (father of the present president of the American Electrochemical Society). In July, 1881, Dr. Acheson was sent as first assistant engineer with the Edison interests at the Electrical Exposition in Paris. He returned to the United States in 1884 and for a time was connected with the Consolidated Lamp Company of Brooklyn and the Standard Underground Cable Company of Pittsburgh. The spirit of experiment was strong with him, and electrical and chemical problems engaged his spare hours.

Early in 1891, Dr. Acheson produced in the electric furnace the first sample of carborundum, the well known abrasive and refractory now used all over the world. The invention of carborundum has been of great benefit to many industries, cheapening the production of numerous articles and improving the finish of many others.

Not long after the invention of carborundum, Dr. Acheson produced the first large sample of artificial graphite. He took ordinary coke and heated it to extremely high temperatures in his electric furnace and, lo and behold! the hard brittle coke was transformed into a soft, unctuous product: graphite. And this graphite he produced artificially was better and purer than the natural mineral "plumbago" or "black lead," as natural graphite is commonly called. Today about 20 million pounds of Acheson graphite is produced annually. The applications number a thousand and one: lubricants, electrodes, crucibles, etc., etc. The tungsten wire of the incandescent lamp owes its existence to "aquadag," an aqueous lubricant of "deflaculated Acheson graphite." The range of our guns was increased 20 per cent by surfacing the inner walls with Acheson graphite. The Acheson product is so fine that it will pass through a chemist's filter paper which ordinarily retains the finest precipitate.

Dr. Acheson's name is known the world over. His career has been a most fascinating and fertile one. Untiring in his zeal and highly skilled in the experimental art, he has transformed, as though by magic, the visions of his active and powerfully imaginative mind into realties that are products of inestimable value to science and the arts.

C. L. Warwick, secretary-treasurer, American Society for Testing Materials, plans to visit the principal industrial and engineering centers on the Pacific Coast, in order to foster the society's development in that territory and to establish closer contacts with the western membership. The Pacific Coast district is fourth among the nine districts into which the country has been divided by the society in relation to A. S. T. M. membership as compared with population and capital invested in manufacturing industries.

Walter S. Barrows

Walter S. Barrows, prominent in Canadian electroplating circles, who was the secretary of the committee of Toronto platers which arranged for the 1928 convention of the American Electroplaters' Society, was signally honored on September 24 for his fine work in that capacity. Mr. Barrows, attending a regular meeting of the Toronto Branch, sat complacently while he heard the final report of the convention committee read, discussed and accepted. John Acheson, chairman of the committee, then spoke a few words, referring several times to the excellent services of Mr. Barrows, who prepared the convention program and did a number of other things in preparation for, and during, the convention. Then, at a prearranged signal, a number of members entered bearing a large oak desk, with desk mat and chair to match, and a beautiful desk lamp,—which were presented to Mr. Barrows in token of the Branch's gratitude for his loyalty and service.

Mr. Barrows, quite overcome by the unexpected honor, immediately rendered thanks to his fellow members and requested that they place their signatures on the desk. The center drawer was removed and all present signed their names to the bottom of it, where Mr. Barrows will be able to see them during the years to come.

The other members of the committee were given a vote of thanks for their good work on behalf of the convention.

D. Walker Wear has been elected president of the Stow Manufacturing Company, Inc., Binghamton, N. Y.

Wilfred S. McKeon, president of the W. A. Fuller Company, Greensburg, Pa., has advised us of the sudden death of his mother early in September, 1928. We join with his many friends in sympathizing with him in his loss.

Arthur L. Tushbant has been appointed director of sales for the Great Lakes Chemical Works, 5440 West Jefferson Avenue, Detroit, Mich. The company manufactures lead, zinc, tin, solder, babbitt metal and special white metal alloys.

Dr. C. L. Mantell, consulting chemical engineer, has returned to the Department of Chemical Engineering at Pratt Institute, Brooklyn, N. Y., for the school year, after serving as Assistant Editor of "Chemical and Metallurgical Engineering" for the summer months.

E. C. Bain, formerly research metallurgist for the Union Carbide and Carbon Research Laboratories, Long Island City, N. Y., is now engaged in research work at the newly established research laboratories of the U. S. Steel Corporation, under the direction of Dr. John Johnston.

W. E. Tierney has been appointed representative in the south and southwest for the Botfield Refractories Company, Philadelphia, Pa., makers of fire brick cement, refractory guns and other materials and equipment. Mr. Tierney is a Tulane University graduate in mechanical engineering. His headquarters will be in New Orleans.

William A. Brecht, at one time president of the Krupp Foundry Company, Lansdale, Pa., has been elected president of the Hajoca Corporation, 120 South 30th Street, Philadelphia, Pa., to succeed J. Harvey Borton. Mr. Brecht was previously vice-president of the Hajoca firm, which was formed by the merger of the Krupp Foundry and other companies.

Joseph A. Ashwell has been appointed purchasing agent for the New Departure Manufacturing Company, Bristol, Conn. Mr. Ashwell, who recently resigned his position as purchasing agent of the American Bosch Magneto Company, Springfield, Mass., succeeds William A. Kimball, who recently left the New Departure company to engage in manufacturing at Newton, Conn.

Thomas A. Edison, inventor, who has been a member of the American Electrochemical Society since the year of its inception, has just been made an 'honorary member" of that body, a rare distinction. In this regard, the Society's announcement says: "Edison's achievements in the electrochemical field are known to all. His alkaline storage battery set a new standard for high capacity at minimum weight. Edison has also contributed many valuable processes and products in the electrochemical plating art. The phonograph record owes its very existence to high perfection in electroplating."

Obituaries

William H. Evans

William H. Evans died on August 18, in Lemont, Ill., following a week's illness. He was secretary-treasurer of the Illinois Pure Aluminum Company, Lemont, Ill., and had been with this company for eighteen years.

William H. Niedringhaus

William H. Niedringhaus, superintendent of the National Enameling and Stamping Company, Granite City, Ill., and a member of the Niedringhaus family which founded that institution, died recently at his home in that city. Mr. Niedringhaus was born in St. Louis seventy years ago, and attended public school there. He had been with the above company for fifty years.

Clarence F. Hotchkiss

Clarence F. Hotchkiss, president of the Stowe Manufacturing Company, Inc., Binghamton, N. Y., died on September 9, 1928.

News of the Industry

Industrial and Financial Events

Hanson-Van Winkle-Munning Convention

The Hanson-Van Winkle-Munning Company of Matawan, New Jersey, held its annual sales convention at the Berkeley-Carteret Hotel, Asbury Park, N. J., September 11th to 15th. The convention opened Tuesday morning with E. N. Boice, Secretary and Sales Manager, presiding. The address of welcome was delivered by A. P. Munning, chairman of the board of directors, and the remainder of the forenoon was devoted to reports by the salesmen on conditions in their various territories. Interesting papers were read during the week by individuals not directly connected with the plating and polishing industry but whose work brings them in daily contact with the broader subject of metal finishing. L. C. Morrow, managing editor of "The American Machinist," spoke on "The Increasing Interest in Metal Finishing"; William M. Corse, consulting metallurgical engineer, addressed the convention on the subject of "Development of Business Through Research"; and Frederick G. Space, purchasing agent for the Seymour Manufacturing Company, spoke on "Sales Ethics."

The convention proper closed on Saturday morning with a summary by Van Winkle Todd, president. In his summing up, Mr. Todd called the year just passed a banner year for the plating industry and predicted a continuance of prosperity based on (1)—the constantly increasing demands for better finishes both for appearance and for rust-resistance; (2)—the increasing use of color, necessitating a bright plate on all metal parts as witnessed by the lavish use of nickel and chromium on all external metal parts of the automobile since the introduction of bright, colored finishes; and, (3)—the replacement of obsolete equipment in polishing and plating departments with modern automatic machinery.

The closing banquet was held at the Engineers' Club in New York City. At the banquet were many men who had spent the greater part of their lives in the plating and polishing industry and, in the course of the evening, these men recalled the early history of plating, its progress to date, and its immense possibilities for the future.

Electroplating Consultants Expand

Weisberg and Greenwald, 71 West 45th Street, New York City, engineers and chemists, with a special department for consulting work in chromium plating, have decided to expand their service to electroplaters and have added laboratory facilities for investigating electroplating and related metallurgical problems, and are increasing their staff so as to make available to the general electroplating industry a chemical engineering service similar to that which they have hitherto offered in chromium plating. This service will embrace not only the design, installation and maintenance of electroplating plants of all kinds, but also research and development work along new lines.

General Bronze Corporation

General Bronze Corporation, New York, reports for the second quarter of 1928 net profits amounting to $215,248, after depreciation and Federal taxes. This compares with $138,257 for the preceding quarter.

Evening Graduate Courses in Engineering

Opportunity is now afforded to engineers, chemists and other technicians located in the metropolitan district of New York City to pursue graduate study during the evening hours. The Polytechnic Institute of Brooklyn, is offering this fall four graduate courses in the evening which lead to the master's degree. The degree of Master of Science in Chemistry, or of Master of Civil, Electrical or Mechanical Engineering is awarded upon the completion of thirty semester-hours of advanced study and upon the submission of a satisfactory thesis. The individual subjects of instruction may also be taken by graduates without reference to candidacy for a degree. Some of the subjects of instruction to be given this fall are Engineering Economics, Advanced Physical Chemistry, Drying, Evaporation and Distillation, Advanced Structures, Electrical Oscillations, Electromagnetic Theory, Heat Power Engineering, Metalography and Heat Treatment, Physics, and Quantum Theory of Radiation.

Graduate classes will open on September 24, and registration may be made on and after September 10 by application to the Dean. The Polytechnic Institute is located on Livingston and Court Streets, immediately adjoining Borough Hall in Brooklyn.

Course in Plating at City College

The College of the City of New York is inaugurating an evening course, open to the public, in principles of practical electroplating. This course is especially designed to train men in the modern scientific control of plating baths to obtain perfectly uniform results with economic efficiency. The course will be given by Dr. L. C. Pan, associated for a number of years with Professor Colin G. Fink in theoretical and applied electrochemistry. The course will be given two evenings per week for one semester and will be held in the Chemistry Building, College of the City of New York, 140th Street and Convent Avenue, New York City. The course begins on September 27th and registration is now open in the Main Building of the City College. The class will be limited to a small number and early applicants will be given preference.

Metals Going to Antarctic

The metal industries will be well represented in the expedition to the Antarctic under Commander Richard E. Byrd, which recently set sail. All the aluminum cooking paraphernalia, both for the Byrd ship and for the airplanes taken along, were supplied by the Aluminum Cooking Utensil Company, Pittsburgh, Pa. The Aluminum Company of America, also of Pittsburgh, supplied Commander Byrd with an airplane propeller, while the Standard Steel Propeller Company, another Pittsburgh firm, has supplied a steel propeller of special design. The airplane is fitted with three Wasp engines, the famous product of the Pratt and Whitney Aircraft Corporation, Hartford, Conn. The plane is a Ford, trimotored ship and will be used in the dash over the South Pole, when the trip is undertaken. Numerous of the metal parts of the ship and plane are of Connecticut manufacture, especially the brass and bronze hardware; other parts of New England also figured in supplying equipment.

Chase Brass Consolidates Interests

A recent announcement by F. S. Chase, president of the Chase Brass and Copper Company, Incorporated, states that all products formerly sold by the Waterbury Manufacturing Company and the U. T. Hungerford Brass and Copper Company, will now be sold under the Chase name and mark. The new trademark, a figure half horse and half man with bent bow and drawn arrow—so aptly illustrative of the chase and thus of the firm name—is distinctive and unmistakable. In addition to its use on all other products of the companies now amalgamated, it will appear on the well known "Alpha" brass pipe.

The first and original plant of the Chase Companies, Inc., was the Waterbury Manufacturing Company, which was founded in 1837. It was formerly called Hitchcock's; later it became known as the United States Button Company. In 1876 it was incorporated under the new name of Waterbury Manufacturing Company, and in 1882 it employed about thirty-seven men, in contrast with the several thousand employed today.

So much brass was being used by 1900 that a new plant, called the Chase Rolling Mill Company, was built to cast and roll the metal needed. Gradually this second unit of the company entered the market as producer of "Chase" brass sheet, rod, wire and tubing. Later, in 1910, with a view to the future of the brass business, a second brass mill, the Chase Metal Works, was founded. It is today one of the largest and best equipped brass and copper mills in the country.

In 1917 these three plants were merged into the present Chase Companies, Inc. Four years later, brass and copper warehouses were started on the East and West costs, and additional warehouses were soon added in important manufacturing cities. Last year the Chase Companies bought the assets of the U. T. Hungerford Brass and Copper Company, which also operated brass and copper warehouses in principal cities. Both the Chase and Hungerford chains of warehouses were united and merged into a separate company named the Chase Brass and Copper Company, Inc., which, in addition to its warehouses business, acts as the selling and distributing company for the mills and factories of the Chase Companies, Inc. This chain of Chase Brass and Copper Company warehouses is now the largest and most complete brass and copper warehouse system in the world.

Radio World's Fair

The Fifth Annual Radio World's Fair was held at Madison Square Garden, New York City, September 17 to 22. The exposition this year, as in the past, presented an imposing array of the products of this youthful, but already giant, industry. While the greater number of the exhibits were finished radio receiving sets, there were quite a number of displays of materials and parts which are used in radio. There was an enlightening exhibition of television, arranged by the General Electric Company, which had a special theater constructed for the purpose of showing motion pictures transmitted by the television process. "The New York Telegram" also had a television exhibit; this consisted of a small receiving set. Among the exhibitors who are primarily metal sellers or fabricators, were the Scovill Manufacturing Company, Waterbury, Conn.; the Aluminum Company of America, Pittsburgh, Pa.; the Gilby Wire Company, Newark, N. J.; Acme Wire Company; Brooklyn Metal Stamping Company; Chicago Solder Company; Cornish Wire Company; National Carbon Company; Polymet Manufacturing Company.

Tin Producers Consolidate

Consolidation of a number of important Malayan tin producing companies has just been concluded. The Anglo-Oriental Mining Corporation directed the merger with a view to arranging for single technical direction and a coordinated policy in the marketing of output. Although the names of companies concerned have not yet been disclosed, it is understood that they control or will control between them approximately 12 per cent of the total world output of tin. This is the most recent of several significant mergers in the tin producing industry reported this year. Earlier in the year a large number of Nigerian companies, controlling 65 per cent of the Nigerian output, were absorbed into single group called the Associated Tin Mines of Nigeria, with a single sales and technical organization. Since then the Anglo-Oriental group, which controls this merged group, has been drawing together concerns in Burma, Siam and Malaya into a single cooperating organization called the Anglo-Oriental (Malaya) Limited.

The significance of the latest consolidation rests in the fact that all these groups will now be associated under single control and the marketing of the greater proportion of the world's tin will in effect be in the hands of three great combines, namely the Dutch, the Patino interests and the Anglo-Oriental group.

Federal Mogul Corporation

The Federal Mogul Corporation, of Michigan, producer of bronze and babbitt, bronze castings, bronze and habbitt bearings and bushings, and allied products, has placed on the market 40,000 shares of common stock of no par value. The shares were sold at $20 each, to yield 6 per cent.

The Federal Mogul Corporation was formed in 1924 by the merger of the Muzzy Lyon Company and the Federal Bearing and Bushing Corporation. Its business, according to the prospectus issued by J. H. Muzzy, chairman of the board of directors, in connection with the new stock issue, has grown to large proportions, amounting in 1927 to $3,933,446 in sales, and, in the first eight months of 1928, to $3,395,953 in sales. The company sells its products to many automobile, railway supply, agricultural machinery and other producers.

Wire and Cable Producers Meet

The wire and cable section of the National Electrical Manufacturers' Association held a meeting in September at Rye, N. Y., with 50 executives of 40 manufacturing companies in attendance. Applications for membership were received from 8 additional concerns. New officers were elected, including H. D. Keresey, of the Anaconda Copper Mining Company, as permanent chairman, and W. E. Sprackling, of the Tubular Woven Fabric Company, as vice-chairman of the wire and cable section.

Copper Producers Form Agency

Four of the leading American copper producing companies have formed a joint sales agency, to be known as the Phelps Dodge Sales Company, Inc., it was announced on September 25. The four producers are the Phelps Dodge Corporation, Nicholas Copper Company, Calumet and Arizona Mining Company and the Old Dominion Company. The company started to function October 1, under the chairmanship of Walter Douglas. The officers are: C. W. Nichols, president; G. R. Campell, vice-president; A. T. Thomson, secretary and treasurer; W. C. Bennett, chairman of advisory committee; C. A. Austin, manager of sales; M. H. Crego, assistant manager of sales. Offices of the company will be at 99 John Street, New York City.

Hoover in Bronze

The striking bronze medallion shown here has been issued in connection with the campaign of Herbert Hoover for the presidency. This medallion, cast directly from sculptors' models by the Medallic Arts Company, 210 East Fifty-first St., New York, has the head of Hoover on its face, and a pin on the back for attaching to the lapel. It is about the size of a penny. The same idea has been carried out in larger form, 2½ in. diameter, for paper weights, etc. The Editorial Advisory Committee of business paper executives is aiding in the distribution of these medallions. In this connection, it might be stated that Herbert Hoover recently attended a dinner of the National Conference of Business Paper Editors, at which he answered inquiries and discussed general questions relating to business and industrial prospects and business organization.

Aluminum Company Investigation

Attorney for the Federal Trade Commission has submitted six additional complaints charging the Aluminum Company of America with unfair trade practices, violation of the Clayton Act and other illegal activities, including efforts to monopolize the supplies of bauxite (aluminum ore). These charges are in the form of amendments to the original charge which has been under consideration by the Commission for some time. Chief among the new complaints is one which charges the Aluminum Company with employing a scheme to monopolize the aluminum castings industry, as well as the aluminum ingot, sheet, scrap and fabricated products industries. The amendments are for the purpose of indicating that the company is still violating the law. The original charges were that the company had done so in the past.

Counsel for the Aluminum Company of America voiced opposition to the new complaints on the ground that they were unrelated to the original complaint.

Incorporations

Nizinite Metals Corporation, Perth Amboy, N. J., has been formed to manufacture nickel and chrome plated sheets, zinc sheet and other metal products, and started operations the latter part of September. According to R. L. Tuttle, president, materials and equipment have been purchased.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Conn.

October 1, 1928.

Frederick S. Chase, president of the **Chase Companies, Inc.**, denies that any negotiations are in progress for merging his concern with the **Michigan Brass and Copper Company** of Detroit and some copper producing company, as has been rumored in some financial and trade papers. Ever since the Anaconda-American Brass merger there have been periodic rumors of consolidations affecting either the Chase Companies, the **Scovill Manufacturing Company,** or both, together with some western brass company and a copper producing company. All have been denied at intervals, although it was admittd that at one time there had been negotiations for a merger of Chase and Scovill which, however, came to nothing. A probable reason for the latest rumor is the fact that the **Detroit Copper and Brass Company,** also of Detroit, was acquired by Anaconda last year and its operation turned over to the **American Brass Company.**

The Beardsley and Wolcott Manufacturing Company has purchased the **Berbecker and Rowland Manufacturing Company** of Waterville, a suburb of Waterbury. **Charles E. Beardsley,** president of the former company, is also president of the **Bridgeport Brass Company.** The purchase was ratified by special meetings of the stockholders of both concerns last month and the actual merger has now been effected. The Berbecker company makes hardware.

The Waterbury Tool Company is manufacturing three winches and three of their variable speed gears, adapted to the winches, for the British dirigible company which is to inaugurate a trans-Atlantic dirigible service this fall or next spring. The winches will be used in connection with the mooring mast to be erected at St. Hubert, near Montreal, Canada, the landing field of the dirigibles. The cost of the three winches and gears will be about $55,000. They will be used to pull the dirigibles in to the mooring mast when it approaches. The local company's variable speed gears are used on all the ships of the United States Navy and in most of the navies of the world for raising and lowering guns, operating gun turrets and for steering gear. They were selected for the dirigible mooring masts because of the necessity for smoothly running and speedily reversible machinery that is capable of instant speed changes in order to handle the dirigibles safely.

The Waterbury Battery Company has supplied a large number of the batteries used by the Byrd Antarctic expedition. The number and value have not been given out.

The French Manufacturing Company will start immediately the construction of an addition to cost more than $45,000. It will be 200 by 60 feet connecting with the present buildings. The company built another addition about one year ago. Steadily increasing production made the addition necessary.

The death in Denver of **Robert H. Ingersoll** was of interest here as for several years the R. H. Ingersoll Company, of which he was the head, owned the former **Waterbury Watch Company** here. For a short time he lived here and was a member of the local Chamber of Commerce. When his concern went into bankruptcy about seven years ago all its assets, including the local plant and the one in Trenton, N. J., were acquired by the **Waterbury Clock Company,** which has operated them since.

Arthur DuBois, formerly an employee of the **American Pin Company,** now owned by the **Scovill Manufacturing Company** has been appointed employment manager of the latter company, succeeding Captain Daniel Fitzpatrick.

The Waterbury Button Co. has obtained from the patent office a trade mark on a new lighter. —W. R. B.

Bridgeport, Conn.

October 1, 1928.

The report of the Industrial Bureau, established three years ago, shows that during that time 24 concerns have been brought to this city, given employment to 3,500 persons, brought many families here, and increased the city's annual payroll $4,000,000.

George Sherman Hadley, secretary of the **Harvey Hubbell Company, Inc.,** and a nephew of the late Harvey Bubbell, died of heart failure on September 11, at the age of 53. He is survived by his father, George Hadley and a brother, Frank W. Hadley.

A conference of traffic managers of state industrial plants was held here September 7. Among those present were representatives of the Bridgeport Brass Company, Crane Company, the American Chain Company, the General Electric Company, the Harvey Hubbell Company, all of Bridgeport; the American Hardware Corporation and the Stanley Works, of New Britain; the Acme Wire Company and the Winchester Arms Company, of New Haven; the Chase Companies, Inc., and the **Scovill Manufacturing Company** of Waterbury; the Russell Burdsal and Ward Bolt Company and the **Yale and Towne Manufacturing Company** of Stamford.

Patents were granted to local men during the month as follows: **John J. Conway,** assignor to the **Acme Sheer Company,** shears and scissors; **George H. Townsend,** radiator cap; and **Frederick K. Heyer** of Stamford, assignor to **Yale and Towne,** lock and bolts. —W. R. B.

Connecticut Notes

October 1, 1928.

HARTFORD—Officers of the recently formed **Veeder-Root, Inc.,** and representatives from various parts of the country held the first general sales conference here since the merger of the Veeder and Root companies. **J. T. Chidsey,** president, and **C. H. Veeder,** formerly president of the old Veeder company, were the principal speakers. Representatives were present from Bristol, New York, Philadelphia, Chicago, St. Louis and Boston.

Veeder-Root, Inc., has furnished the Byrd Antarctic expedition with odometers to be attached to its dogsleds for measuring the distances traversed. Only three days were given in which to make up and send the order which was for 12 complete sets and six spare odometers.

The Bush Manufacturing Company, manufacturers of radiator caps for automobiles, will start shortly the erection of a one-story factory addition 100 by 50 feet.

NEW BRITAIN—Construction work now going on at the **Fafnir Company** plant which will add nearly 50 per cent to the available manufacturing facilities. With the three new buildings being erected the plant will cover nine acres. When the concern was started in 1911 it covered half an acre.

Directors of the **Stanley Works** last month declared the regular quarterly dividend of 2½ per cent on the common, payable October 1, and the regular dividend of 1½ per cent on the preferred stock, payable November 15.

NEW HAVEN—Merger of the **Universal Wire Machinery Company** and the **Wire Machinery Corp. of America** has been effected. The new concern is to be known by the latter name. It is capitalized at $50,000. The new officers are: President, J. P. Barclay; treasurer, Merritt Vanderbilt; vice-president, Leslie K. Allen; directors, the above and Raymond B. Girard, formerly president of the Wire Machinery Corporation, and Josiah Judd.

An explosion of lacquer thinning fluid caused a fire at the plant of the Atlas Manufacturing Company last month which caused damage of $100,000. The fire spread so rapidly that the 50 employees of the room barely escaped, many sustaining burned clothing and superficial body burns. Twelve fire companies were required to subdue the flames.

MERIDEN—George H. Wilcox, president of the **International Silver Company** for 21 years, resigned last month and was elected chairman of the board of directors, a newly created position. He has been succeeded as president by **Clifford R. Gardiner,** former purchasing agent. **Evart C. Stevens** of Wallingford has been elected by the stockholders as a diretor to fill the vacancy caused by the death of **George D. Munson.**

The International Silver Company has declared its regular dividend of 1¾ per cent on the preferred stock, payable October 1.

BRISTOL—The E. Ingraham Clock Company will erect shortly a five-story addition to cost about $200,000. It will measure about 160 by 60 feet. The third floor will be level with the car platform on the company's siding, eliminating the trucking of finished goods to the freight depot. The new building will be connected to the present buildings by a series of bridges. Another addition to be erected is a coal trestle and a new switch to the main railroad track. The company is also to fill up the branch of the Pequabuck River which runs through its land and will use the land thus formed for storing carboys and small trucks. For the past five years the company has built a new addition each year.

The New Departure Manufacturing Company will break ground this month for an addition to its forge plant, 200 by 126 feet, of fireproof brick and steel. It will house 12 upset forging machines, one of which will be the largest of its kind ever constructed. It will make possible an increase of 15,000 per day in production of ball bearings.

President DeWitt C. Page of the **New Departure Manufacturing Company** has been selected by the Republican party as one of the presidential electors from this state.

Directors of the **Bristol Brass Corporation** have declared the regular quarterly dividend of 1¾ per cent on the preferred stock and also voted to pay 1¾ per cent on the accumulated preferred dividends, both payable October 1. This will leave $24.50 per share in accumulated preferred dividends still unpaid.

TORRINGTON—The Torrington Company stockholders at a meeting here last month voted to reduce the company's capitalization from $11,000,000 to $7,000,000 by the retirement of the 40,000 outstanding shares of preferred and 120,000 shares of common stock which have never been issued. The stockholders also voted to reduce the par value of the common stock from $25 to $12.50 and to issue two shares for each share now held by stockholders. The company's report for the year ending June 30 shows a net of $7.93 a share, totalling $2,194,407, compared with $1,862,011 for the previous year.

George H. Knight last month received a patent on an adjustable machine support which he assigned to the **Hendey Machine Company. James M. Dayton** received a patent on a quick action gate valve.

ANSONIA—Production at the local mills of the **American Brass Company** has never been higher than now, the plants being operated on day and night shifts. Business is of such volume that the west rod mill, which had been closed for several years since the erection of the modern shop, has been opened and put in service.

WINSTED—The Winsted Insulated Wire Company is making plans for a factory addition necessitated by the expansion of the company's business.

Business of the **William L. Gilbert Clock Company** is improving rapidly and more help is being added. Orders from salesmen in all parts of the country are coming in in large numbers and conditions for the winter looks good. **President Norman F. Thompson, Jr.,** has left for Rockford, Ill., St. Louis, and other western cities on a business trip.

Ralph E. Strand has resigned as president of the **Strand and Sweet Manufacturing Company** and the directors have elected **Edward P. Jones** as his successor. The stockholders have added **Walter V. Davey** to the board of directors.

THOMASTON—The large four story addition to the **Seth Thomas Clock Company** will be completed this month. Following its completion, additions are planned for the west end of the plant which will do away with the present wooden buildings there.

MIDDLETOWN—Clinton H. Warner, of the local office of the **Russell Manufacturing Company,** has been appointed manager of the New York office of the company.—W. R. B.

Middle Atlantic States

Trenton, N. J.

October 1, 1928.

The New Jersey State Department of Labor inaugurated an inter-plant safety contest on September 17 and will continue the same for thirteen weeks, until December 16, when the plants showing the best records will be awarded prizes. Dr. Andrew F. McBride, Commissioner of Labor, sent letters to all firms in the state, in which he said that the campaign was fostered by the Department of Labor in the belief that every manufacturing concern is anxious to reduce its accident frequency and severity. He said that about 90 per cent of the accident cases finding their way into the compensation courts are preventable accidents. Monthly reports are being submitted by each firm and all information is being kept confidential.

The Binder Electric Supply Company, Trenton, N. J., has filed a denial to patent infringement charges, entered in the United States District Court by the **Crescent Brass Company** of Reading, Pa. The charge, according to the Trenton concern, is based on the sale of one lamp equipped with a patented canopy and bracket. Furthermore, it is stated, the lamp was ordered at the instance of an agent of the plaintiff and sold to him. The canopy and bracket, as set forth in the document, was of rare workmanship and required especial skill in construction. Any sale constitutes an infringement, according to the plaintiff.

The following concerns have been chartered in Trenton: **Super-Held Service Co.,** Passaic, $15,000, deal in aluminum goods. **Carbex Chemical Company,** Red Bank, $125,000, manufacture chemicals. **American Chemical and Engineering Company,** Paterson, $100,000, manufacture chemicals. **Camden Chemical Company,** Camden, 2,500 shares no par, chemicals. **Gem Specialty Manufacturing Company,** Camden, $125,000, manufacture metal cans. **Viehweger Lock Company,** Elizabeth, $250,000 preferred and 20,500 shares common, manufacture locks. **Triumph Manufacturing Company, Inc.,** Union City, $25,000, manufacture lamps.—C. A. L.

Newark, N. J.

October 1, 1928.

The Newark Transformer Company, manufacturer of electrical transformers, has purchased the property at 62 Sherman Avenue and will erect a factory 25 by 100 feet. This will be an extension of its present factory next door. The Transformer company is very busy.

The Spicer Manufacturing Company, South Plainfield, has decided not to move its big plant to Cleveland, Ohio, as was first planned. The company maintains a plant in Cleveland.

Everything was in readiness for the removal when the order came through that no change was to be made. The company now intends to continue certain departments at South Plainfield indefinitely, although they are operated with a reduced force of employes.

Newark concerns incorporated include the following: **Perfection Knife Grinding Company** $25,000, cutlery. **Kenilworth Chemical Corporation,** 200 shares, no par, manufacture chemicals. **Automotive Standards, Inc., of Jersey,** 500 shares no par, batteries. **Mersco Screen Company,** 100 shares no par, manufacture screens. **J. S. Miller, Inc.,** $100,000, chemicals. **Schuman and Donchi, Inc.,** $75,000, jewelry.—C. A. L.

Middle Western States

Toledo, Ohio

OCTOBER 1, 1928.

Practically all Toledo plants are operating full time, with prospects favorable for a busy fall and winter. Plants using brass, copper and aluminum extensively are so varied that it requires a pretty stiff business decline to affect all of them at once. But now all of them are busy. Like Detroit and Cleveland, Toledo is engaged extensively in manufacturing for the motor car trade. This business is unusually heavy.

The plating plants, many of which are attached to concerns manufacturing various commodities, have been active for a long time and their prospects remain favorable for an indefinite period ahead.

Taking everything as a whole, Toledo is most favorably situated so far as the metal industries are concerned.—F. J. H.

Cleveland, Ohio

OCTOBER 1, 1928.

Cleveland manufacturers are entering the fall and winter period with a favorable outlook. This is particularly true so far as the nonferrous metal industry is concerned. Plating concerns are also active and will probably continue so for an indefinite period. Automotive accessory concerns are more busy at this time than they were a year ago. Most of them are working full time and some are even operating nights. Many of these concerns are engaged extensively on contracts from Detroit motor car companies. The employment situation is encouraging, and everything now points to a prosperous winter.

Jewelry manufacturers are not particularly active. This industry has been rather quiet for a considerable time.—F. J. H.

Detroit, Mich.

OCTOBER 1, 1928.

Manufacturers in this territory are approaching the winter months with practically every plant operating. While there has been nothing in the way of a boom, the non-ferrous metal industry has been more favored than those in many other lines. Plants are employing more persons at the present time than ever before. Accessory plants are unusually busy in meeting the demand from the motor car field.

Manufacturing jewelers are not so favored. This industry has been lagging all through the summer. Those engaged in this business in Detroit are facing extreme competition and have about all they can do to keep their plants going full time. The most favored ones are those who have some specialty that is meeting with popular favor.

The Johnson-Larsen Company has been awarded the contract for alteration of the heating plant for the factory of the **Michigan Smelting and Refining Company,** on Joseph Campau Avenue. The architect is Christian Brandt.

Directors of the **Bohn Aluminum and Brass Corporation** recently issued a quarterly dividend of 75 cents a share, payable October 1. Following the directors' meeting, P. A. Markey, treasurer, said: "We are in excellent financial shape and the outlook for the balance of the third quarter continues good. Two of our plants are working day and night."

The C. M. Hall Lamp Company reports net profits for seven months as $514,358. Directors have declared a dividend of 25 cents a share.

The Olds Motor Works at Lansing is adding to its enameling plant a two-story addition containing 9,600 square feet of floor space. This will increase the capacity of the enameling plant by 70 per cent, it is estimated. An addition to the heat treating plant is also underway, increasing the floor space 10,150 feet.

The Wolverine Enameling Company now has floor space of 65,000 square feet, devoted exclusively to enameling over Parkerized metal. The constant expansion of this concern is due largely to demand from the electric refrigeration and the motor car industries. The plant turns out, in terms of sets of sheet metal motor car parts, enough for 20,000 cars a month. In terms of two-coat finished parts, the plant has an approximate daily capacity of 140 tons.

The Aluminum Products Company has been incorporated at Plainville, Mich. Its capital stock is $100,000. It will manufacture and deal in foundry products. The stockholders are J. F. Eesley, G. E. Pipp, and Frank Shinville, all of Plainville.

The Paramount Aircraft Corporation, South Jefferson Avenue and Rust Street, has been incorporated at Saginaw, Mich. It will manufacture and deal in aircraft, aircraft parts and engines. The stockholders are Joseph E. Behse, Walter J. Carr and Arthur Weadock, all of Saginaw. The company has $100,000 preferred stock and 10,000 shares no par value.—F. J. H.

Other Countries

Birmingham, England

SEPTEMBER 19, 1928.

Trade is improving in the metal industries of Britain. Nonferrous works are not so well employed as they were a year ago, but business has rallied since the August holidays. Midland makers are encouraged by the statistics of unemployment which show a substantial decrease.

Makers of aluminum castings have had a very good run on the production of cylinders and other parts used in the automobile industry. The trade has been quiet within the last week or two, but is expected to revive when next season's designs are out.

The brass trade, on the whole, is well employed, and a good deal of enterprise is being shown in the cultivation of overseas markets. Notwithstanding the growth of the industry in many countries which not many years ago imported practically all their brass goods, the British manufacturers manage to maintain the improvement previously noted in their exports. During the first seven months of this year exports of brass products totaled 13,980 tons, as compared with 11,143 tons in the corresponding period of last year. There has been a decline in the exports of brass wire, but a substantial advance in shipments of sheets and strip and miscellaneous wares.

Birmingham manufacturers complain that the colonies, in their efforts to build up their own factories, have taken a good deal of trade from the British exporter. But in certain specialized products the Birmingham maker can easily hold his own. This is particularly the case among makers of silver and electroplate. In this trade there is a constant demand for table novelties, fashions in which change very rapidly. The firms who can keep up with this demand are confident that they will obtain plenty of orders and be able to old their own against competition, both at home and abroad. The last four months of the year are expected to be the busiest of the whole twelve, and September is making a good start.

In the metal bedstead trade, manufacturers report improving export business. Orders and inquiries are coming in from India, Africa and Egypt. Among these there is occasionally the expensive and artistic article ordered by wealthy princes in Eastern lands. Conduit tubes are being exported in larger quantities to South Africa, but there is a good deal of competition from Germany.

The home trade in brass fittings, used in building and engineering, is irregular, not only because the pressure for houses has eased up, but also owing to the fact that brass has declined in popularity with householders, and been replaced in many instances with bronze and oxy-copper. Prices are cut very finely among home manufacturers, some of whom say that many of the orders taken are barely remunerative. Formerly there were contracts which came in the regular routine of business and on which they could always reckon upon a reasonable margin of profit. Now those contracts are open to general competition and dangerously low quotations are sometimes given to secure them. With the falling off in standard lines, however, brass foundries are branching out in other directions. Water fittings and heating fittings of new design are being introduced, and it is believed that improved methods of manufacture will produce a more efficient article with higher finish, without adding to the cost. Of late the British market has not been invaded by foreign water fittings to the extent that it was before marking was required under the Merchandise Marks Act, so that the purchaser might be informed of the origin of the goods offered. It is considered a defect in the regulations that the goods can be imported unmarked, the obligation being laid on the seller to comply with the order. There are strong suspicions that this affords a loophole through which unidentified foreign fittings are still being disposed of.

The busiest departments in hollow ware are the wrought enameled and aluminum. Midland manufacturers of aluminum ware are showing a more ready disposition to cater for overseas countries requiring cheaper grades. The recent duty applied by the Government to wrought enameled hollow ware imported into this country has had a distinct effect in reducing foreign competition. Output of South Staffordshire works has shown a big increase.

—J. H.

Business Items—Verified

State Manufacturing Company, 4724 South Turner Avenue, Chicago, Ill., is now using its recently completed factory building. The company manufactures buffing compounds and allied products.

Alexander Haigh, Boston, Mass., who represents several manufacturers of foundry equipment, has removed his offices to No. 524 Oliver Building, 141 Milk Street, from his former location in the Massachusetts Trust Building.

Higgins Brass and Manufacturing Company, 12435 Dequindre Street, Detroit, Mich., will soon start work on an addition that is to cost over $50,000 with equipment. The company operates rolling mill, tinning and soldering departments.

Acheson Graphite Corporation, Niagara Falls, N. Y., has become affiliated with the Union Carbide and Carbon Corporation, the latter having acquired its common stock. No changes affecting operation of the company are expected at this time, according to Lyman C. Judson, sales manager.

Eaton-Kent, Inc., 17 Academy Street, Newark, N. J., heating equipment and industrial apparatus manufacturers and distributors, have leased a portion of the former plant of Heller Brothers Company, which will be used primarily as a warehouse, and also as an assembly shop for forced draught equipment.

New Brass Ware Company of Canada, Ltd., 2320 Aird Street, Montreal, has awarded contract for construction of a foundry addition, 43 by 100 feet in area. Equipment for this addition has not been purchased as yet. The company casts brass, bronze, aluminum and other metals, has a brass machine shop and other departments.

M. L. Oberdorfer Brass Company, New York City, has moved to larger quarters at 149 Church Street, where a complete stock will be kept on hand for demonstration. The company was formerly at 1 Broadway. It makes pumps, bronze bars for bushings, castings in aluminum, brass, bronze and all other non-ferrous metals and alloys. The new telephone number is Barclay 5039.

Gibby Foundry Company, East Boston, Mass., manufacturers of iron and brass castings, whose plant was seriously damaged early this year by fire, states that conviction of the incendiary has been obtained and the plant rebuilt. New machinery has been added and operations have been resumed. Arthur W. Gibby is president and George H. Gibby is treasurer and general manager.

Armstrong Furnace Company, London, Ohio, plans construction of a new plant on Fleniken Road, Columbus, Ohio, comprising two 1-story units to cost about $40,000 equipped. The company is headed by M. B. Armstrong, president; P. H. Hommond, secretary and sales manager; R. W. Boyd, vice-president and treasurer; L. A. Lenhart, production manager; J. L. Bopeley, purchasing agent.

Schilling-Evertz Company, 1924 Ellis Street, Bellingham, Wash., plans expansion of operations, following purchase of a half-interest by L. R. Ellis, of Clayton, N. Y. Capital stock of the company has been raised to $100,000, half of which is added capital. The company manufactures brass, bronze and wire work and is said to have $250,000 worth of orders booked. The new member will take an active interest in the firm.

J. J. Siefen Company, formerly of Greenville, Mich., have removed to Lansing, Mich., where they are more centrally located to serve the plating and polishing industry with buffs, cleaners, compounds, brushes, and other equipment and supplies. The company represents several large manufacturers, including Apothecaries Hall Company, Indiana Buff Company, Luster Company, Keystone Emery Mills and Aeroil Burner Company.

The Stewart-Kay Company, 2480 East 22nd Street, Cleveland, Ohio, was formerly known as the Scott-Ullman Company of 3311 Perkins Avenue, N. E., Cleveland. The company leased about 10,000 sq. ft. of space at the East 22nd Street address in order to provide for expansion. It manufactures electrical fixtures and equipment and operates a brass machine shop, spinning, soldering, brazing, plating, polishing, grinding and lacquering departments.

The Brown Instrument Company, Philadelphia, Pa., recently started extensive improvements to its heating plant. Boilers are to be added and there will be a change from coal to oil fuel. A feature of the work will be the installation of Brown liquid gauges and other Brown instruments in connection with the boiler plant. One of these will enable the engineer to know electrically the temperature in any part of the Brown plant without leaving the boiler room.

Pierson-Larkin Refrigerating Corporation, Atlanta, Ga., is completing work on a new plant which the company will operate for the manufacture of a patented aluminum electric refrigerator coil, which the company claims is considerably more efficient than other types of coil, and by means of which harmful dehydration of refrigerated products is avoided. Lester U. Larkin is the inventor and is interested in the firm, which is headed by V. P. Warren, 905 Fair Street, Atlanta.

Machinery and Equipment, Ltd., Hamilton, Canada, which succeeds Wettlaufer Brothers, Ltd., of Toronto, and the L. and P. Manufacturing Company of Niagara Falls, is now in operation. Company makes builders' machinery, garage equipment, snow plows, etc., and also operates a foundry. Officers are W. J. Southam, president; William LaBombard, vice-president and managing director; S. B. Nelson, secretary-treasurer. Company has authorized capital of 5,000 shares of $100 par value preferred and 20,000 shares no par common stock.

Caskey Brass and Bronze Works, Inc., Philadelphia, Pa., which was established over fifty years ago, has just incorporated in order to provide for expansion. The company manufactures non-ferrous castings. It is exclusive selling agent for "Everbrite" casting metal, made by the American Mond Nickel Company, and also is one of the foundries producing castings from this alloy. **F. E. Shipley,** president, states that the expansion now planned is due mainly to the company's great success in marketing this alloy in the chemical, high temperature and high pressure steam fields.

The Lincoln Electric Company of Cleveland, Ohio, announces the opening of a San Francisco office at 533 Market Street in charge of W. S. Stewart. A complete stock of "Lince-

Weld" motors and "Stable-Arc" welders and arc welding supplies is being carried. L. P. Henderson, formerly of the Chicago office, has been transferred and put in charge of the Minneapolis district. Robert Notvest has been transferred from Kansas City to Indianapolis, where he will have charge of the Indianapolis district. R. E. Mason has been sent to Kansas City to replace Mr. Notvest. N. L. Nye has been stationed at Akron, Ohio, under the direction of R. P. Tarbell, the company's manager in the Cleveland district.

Second National Fuels Meeting

The Fuels Division of the A. S. M. E. has invited all organizations and agencies interested in fuels to participate in the Second National Fuels Meeting, Cleveland, Ohio, September 17 to 20, 1928.

Babbitt Metal Consumption Larger

The total apparent consumption of babbitt metal in August, based on reports received by the Department of Commerce from 31 firms, was 4,755,662 pounds as compared with 4,692,825 in July and 5,496,659 in August, 1927. This consumption is calculated from sales by manufacturers and consumption by those firms (among them several important railroad systems) which consume their own production. In the following table, covering data for each month since January, 1927, the sales of babbitt metal are shown separately from the consumption in the producing plants.

Review of the Wrought Metal Business

By J. J. WHITEHEAD,
President, Whitehead Metal Products Company of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

OCTOBER 1, 1928.

Two advances in the price of ingot copper during September, with possibilities of still higher prices, have developed a tremendous amount of active buying to fill consumers requirements of brass and copper fabricated materials over the balance of the year. As a result of this accelerated buying movement the manufacturers of sheets, rods, tubes and wire have sold the major part of their production for the next three months. Contracts and specifications have been placed on so large a scale that in some departments deliveries are difficult to obtain without waiting from six to eight weeks.

For some time past it has been predicted that any indication of a rise in copper prices would produce a large amount of business, but even those who were most optimistic were not ready to predict that there was a probability of any such extreme activity as has actually occurred. However, it may be recalled that for a long time —even through the summer months—the mills have been running almost at capacity on day to day business, with buyers favorably placing orders on a hand to mouth basis for immediate needs only, with little if any consideration for future requirements. The advance in copper prices come suddenly and almost without previous warning and in the rush to get under cover the mill order books were swamped.

It is felt that with the tremendous consumption of non-ferrous metals continuing, the probability is all for still higher prices. Consequently consumers are placing orders much more freely than heretofore and the mills are expected to be running overtime for the balance of the year if not for a much longer period.

Producers of nickel are unable to keep up with their orders. There are no stocks available and deliveries are several weeks behind.

Much metal and copper nickel alloys are also continuing in good demand and large tonnages are daily moving into old established lines as well as new developments. Producers of these metals are planning new publicity and sales activity for the coming year and are optimistic as to the outlook.

Metal Market Review

By R. J. HOUSTON,
D. Houston & Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

OCTOBER 1, 1928.

Copper

Activity and strength were the chief features of the copper market during September. Consuming buying, both domestic and foreign, was on a very heavy scale and the situation showed many signs of unmistakable basic soundness. The movement of copper from the hands of producers into all consuming channels reached its maximum stride recently, and prompt and future deliveries were in active demand as the trade generally realized that current conditions were favorable to an upward revision of prices.

Meantime the situation continued to strengthen as extensive orders poured in from home manufacturers and foreign consumers. Sales steadily expanded, and September business swelled to enormous proportions. Unsold supplies for September and October were consequently greatly reduced in the first half of the past month. A significant development was the heavy demand for forward deliveries. As a logical result of the increasing interest of consumers the market was advanced on September 15 from 14¾c to 15c delivered to Connecticut Valley points. On the same date the export price was raised from 15c to 15¼c c.i.f. European ports. Stocks of refined copper in producers hands on September 1 were equal to less than two weeks' supply. The market is in very strong position, and many factors point to higher prices in the near future. Aggregate sales in September were on a tremendous scale both for domestic and export account. There was feverish eagerness to cover consuming requirements and prices were advanced on September 24 to 15¼c Connecticut and 15½c c.i.f. Europe.

Zinc

Conditions in the zinc market have remained steady for several weeks at 6.60c New York and 6.25c East St. Louis. There was a fair demand but it lacked volume sufficient to lift the market out of the rut into which the recent rate of production has brought it. The excessive output of ore has placed a heavy handicap upon favorable developments for the slab metal. There has been some reduction of ore production during recent months, but further curtailment appears to be necessary to revive confidence and give impetus to the forces of improvement. A brighter outlook, however, is indicated as the result of efforts to place the industry on a more satisfactory foundation.

Tin

An outstanding development in the tin situation recently has been the comparatively narrow price fluctuation. During the first three weeks of September the market for prompt Straits tin moved between 47c and 48⅛c. A year ago market values showed a variation of 5⅞c for the month of September. Price in the first half of last month was 16¾c per pound below the high quotation in September, 1927. Tin, like other metals, has felt the

unrelenting pressure of increased production. Growing output and larger visible supplies have caused considerable apprehension in trade circles. Consumption, however, is large and expected to be more urgent, and for that reason bearish operations at this juncture might prove rather risky.

Tin buying improved near the end of the month and prompt Straits sold at 49c, October 48⅝c and November 48⅜c.

Aluminum

Consumption of aluminum holds up at a high level and prices are firmly maintained at 24.30c for 99 per cent plus material and 23.30c for 94 per cent plus grade. The automotive industry is taking a heavy tonnage of the metal, and demand from other consuming interests continues large, with good prospects for the balance of the year. From present indications it looks as if domestic requirements for 1928 will exceed all former records.

Antimony

Improvement in prices and a moderate degree of activity were features in the antimony situation last month. Spot material was recently quoted at 10⅞c duty paid, but the prompt position was held at a premium above offerings for future delivery. Chinese holders are reported to have formed a combination for establishing better prices and reducing output. Buyers have been cautious lately, but were inclined to buy on a limited scale for October-November shipment at a shade under sellers' price. There is a substantial stock held here, but China shipments have been on a restricted scale for several months.

Market is steady on basis of 10⅝c for spot, and 10⅜c to 10½c for October-November arrival.

Lead

New business in lead was maintained in large volume throughout September. Prices were advanced on September 17 to 6.30c at St. Louis and to 6.50c at New York. The higher rate gave stimulus to buying and consumers bought heavily for all positions up to November. Present price is the highest this year. Large scale consumption is apparent by the heavy deliveries for domestic use. There was also a decrease in stocks of 1,487 tons during August. Surplus supplies of refined and antimonial lead on September 1 were the lowest since April 1.

Quicksilver

The market for quicksilver touched its highest point in several years recently with quotations as high as $134 a flask. The upward movement has been stimulated by a rise in the London price. There are also reports of a combination by Spanish and Italian producers to control output. This is expected to affect the price to buyers, and some parties profess to see still higher prices.

Platinum

Refined platinum continues to quote $75 per ounce. The article has been in plentiful supply and there are no special developments to note.

Silver

Conditions in silver have lacked snap and vigor lately. The market at this writing is quoted 57⅛c per ounce and recently touched 56⅞c, the lowest figure in eight months. China and India have operated on a limited scale, but weakness in the Far East had a depressing effect on market movements. European governments have reduced the percentage of silver going into their subsidiary coinage and that fact has undoubtedly cut down demand to a certain extent.

Old Metals

Rising prices for new copper have strengthened the market for all lines of scrap copper and special brass grades. Buyers have followed the upward trend and trading has been active. Dealers, consumers and exporters are all showing renewed interest in the situation. Lead scrap also displays firmness owing to the stronger tone for pig lead. Prices New York dealers are paying for material quote as follows: Heavy copper 12¾c, light copper 11⅛c to 11¼c, heavy brass 7¼c to 7½c, new brass clippings 10¼c to 10½c, heavy lead 5c to 5.35c, old zinc 3¼c, and aluminum clippings 16¾c to 17c.

Daily Metal Prices for the Month of September, 1928

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	3*	4	5	6	7	10	11	12	13	14	17
Copper c/lb. Duty Free											
Lake (Delivered)	.....	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	15.125
Electrolytic (f. a. s. N. Y.)	.....	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	15.00
Casting (f. o. b. N. Y.)	.....	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.60
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.											
Prime Western	.....	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Brass Special	.....	6.40	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35
Tin (f. o. b. N. Y.) c/lb. Duty Free											
Straits	.....	48.00	47.50	47.50	47.00	47.00	47.00	47.50	47.625	47.50	47.875
Pig 99%	.....	47.00	46.50	46.50	46.25	46.125	46.125	46.625	46.375	46.375	47.00
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	.....	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.30
Aluminum c/lb. Duty 5c/lb.	.....	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb											
Ingot	.....	35	35	35	35	35	35	35	35	35	35
Shot	.....	36	36	36	36	36	36	36	36	36	36
Electrolytic	.....	37	37	37	37	37	37	37	37	37	37
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	.....	10.125	10.125	10.375	10.50	10.50	10.75	10.75	10.75	10.625	10.875
Silver c/oz. Troy Duty Free	.....	58.25	58.125	57.75	57.75	57.875	57.75	57.625	57.75	57.50	56.875
Platinum $/oz. Troy Duty Free	.....	75	75	75	75	75	75	75	75	75	75

	18	19	20	21	24	25	26	27	28	High	Low	Aver.
Copper c/lb. Duty Free												
Lake (Delivered)	15.125	15.125	15.125	15.25	15.25	15.25	15.25	15.25	15.25	15.25	14.875	15.046
Electrolytic (f. a. s. N. Y.)	15.00	15.00	15.00	15.00	15.25	15.25	15.25	15.25	15.25	15.25	14.75	14.947
Casting (f. o. b. N. Y.)	14.60	14.60	14.60	14.75	15.00	15.00	15.00	15.00	15.00	15.00	14.35	14.595
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Brass Special	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.40	6.35	6.353
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	47.875	48.125	47.875	49.00	49.00	48.75	49.00	49.75	49.50	49.75	47.00	48.072
Pig 99%	47.25	47.625	47.50	48.50	48.50	48.625	48.75	49.50	49.125	49.50	46.125	47.382
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	6.35	6.35	6.35	6.35	6.325	6.325	6.325	6.325	6.325	6.35	6.25	6.293
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	37	37	37	37	37	37	37	37	37	37	37	37
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	10.875	10.875	10.75	10.75	10.875	11.00	11.125	11.25	11.25	11.25	10.125	10.743
Silver c/oz. Troy Duty Free	56.875	57.00	57.25	57.375	57.625	57.125	57.00	57.50	57.375	58.25	56.875	57.493
Platinum $/oz. Troy Duty Free	75	75	75	75	75	75	75	75	75	75	75	75

*Holiday.

Metal Prices, October 1, 1928

NEW METAL

Copper: Lake, 15.25. Electrolytic, 15.25. Casting, 15.00.
Zinc: Prime Western, 6.25. Brass Special, 6.35.
Tin: Straits, 50.00. Pig, 99%, 49.625.
Lead: 6.325. **Aluminum,** 24.30. **Antimony,** 10.125.
Nickel: Ingot, 35. Shot, 36. Elec., 37. Pellets, 40.
Quicksilver: flask, 75 lbs., $134. **Bismuth,** $1.70.
Cadmium, 80. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 57.875.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $75.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10 to11¼
Brass Ingots Red	12 to13½
Bronze Ingots	12½to16
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	24 to40
Manganese Bronze Ingots	12½to16½
Manganese Bronze Forging	32 to42
Manganese Copper, 30%	25 to35
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	14 to16
Phosphor Copper, guaranteed 15%	18 to21
Phosphor Copper, guaranteed 10%	17 to20
Phosphor Tin, no guarantee	60 to70
Silicon Copper, 10%, according to quantity	28 to32

OLD METALS

Buying Prices		Selling Prices
12¼to12¾	Heavy Cut Copper	13¾to14
12 to12½	Copper Wire	13 to13¼
10 to10½	Light Copper	11¾to12¼
10 to10¼	Heavy Machine Composition	11 to11½
7¾to 8	Heavy Brass	9¼to 9½
6½to 6¾	Light Brass	8 to 8¼
7¾to 8	No. 1 Yellow Brass Turnings	9¼to 9¾
9¼to 9½	No. 1 Composition Turnings	10¾to11
5½to 5¾	Heavy Lead	6¾to 7
3½to 3¾	Zinc Scrap	4¾to 5¼
8 to10	Scrap Aluminum Turnings	12½to14¼
13 to13½	Scrap Aluminum, cast alloyed	17½to18½
19 to20	Scrap Aluminum, sheet (new)	22 to22½
35 to37	No. 1 Pewter	41½to43½
11½	Old Nickel Anodes	13½
17½	Old Nickel	19½

Wrought Metals and Alloys

COPPER SHEETS

Mill shipment (hot rolled) .....24c. to 25c. net base
From stock .....25c. to 26c. net base

BARE COPPER WIRE

17⅛c. to 17¼c., net base, in carload lots.

COPPER SEAMLESS TUBING

25½c. to 26½c., net base.

SOLDERING COPPERS

300 lbs. and over in one order .....22½c. net base
100 lbs. to 200 lbs. in one order .....23c. net base

ZINC SHEET

Duty sheet, 15% Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount ..... 9.25 net base
Casks, jobbers' price ..... 9.75 net base
Open casks, jobbers' price .....10.25 to 10.50 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price, ton lots.....33.30c.
Aluminum coils, 24 ga., base price, ton lots.....31.00c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 60¾c. to 62¾c. per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect May 25, 1928
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.19¾	$0.21¼	$0.23¼
Wire	.20¼	.21¾	.23¾
Rod	.17½	.22	.24
Brazed tubing	.27¾	.....	.33
Open seam tubing	.27¾	.....	.33
Angles and channels	.30¾	.....	.36

BRASS SEAMLESS TUBING

24⅝c. to 25⅝c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	21¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	19¾c. net base
Muntz or Yellow Rectangular sheet other Sheathing	20¾c. net base
Muntz or Yellow Metal Rod	17¾c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	27½c.	10% Quality	30½c.
15% Quality	29 c.	15% Quality	34¼c.
18% Quality	30¼c.	18½ Quality	37½c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs. 25c. over. Prices f. o. b. mill.

Supply Prices, October 1, 1928

ANODES

Copper: Cast	21¾c. per lb.	Nickel: 90-92%	45c. per lb.
Rolled, oval	21⅜c. per lb.	95-97%	47c. per lb.
Rolled, sheets, trimmed	22⅝c. per lb.	99%	49c. per lb.
Brass: Cast	22¾c. per lb.	Silver: Rolled silver anodes .999 fine are quoted from 62¾ to 64¾c., Troy ounce, depending upon quantity.	
Zinc: Cast	12 c. per lb.		

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.	
12" 20 ply 64/68 Unbleached	$31.00
14" 20 ply 64/68 Unbleached	39.95
12" 20 ply 80/92 Unbleached	33.05
14" 20 ply 80/92 Unbleached	44.80
12" 20 ply 84/92 Unbleached	42.50
14" 20 ply 84/92 Unbleached	57.60
12" 20 ply 80/84 Unbleached	38.35
14" 20 ply 80/84 Unbleached	52.00
Sewed Pieced Buffs, per lb., bleached	45-70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.12-.17
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic, 75 and 125 lb. drums	lb.	.21-.22
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.17¾-.22¼
Denatured, drums	gal.	.45-.53
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride, solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls.	lb.	.03¾
Sulhpocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls.	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.28
Chromic Sulphate	lb.	.37
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.16-.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls.	lb.	.06
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry, bbls.	lb.	.29
Chloride, bbls.	lb.	.18
Salts, single, 300 lb. bbls.	lb.	.10½
Salts, double, 425 lb. bbls.	lb.	.10
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09
Potassium Bichromate, casks (crystals)	lb.	.09
Carbonate, 96-98%	lb.	.06¾-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.49½-.54¼
Cyanide (fluctuating)	oz.	.57-.66
Nitrate, 100 ounce lots	oz.	.42¾-.51½
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.19
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.37-.38
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03¾